



MÁSTER UNIVERSITARIO EN INGENIERÍA DEL SOFTWARE - EUROPEAN MASTER IN SOFTWARE ENGINEERING

Educational Planning Course 2025-26
First and Second Semester

Computer Science and Engineering School
Universidad Politécnica de Madrid

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1 Enrollment Dates

- **First period:** 23-31 July, and 4-12 September 2025
- **Second period:** still to be determined

First semester starts on 8 September 2025

Second semester starts on 2 February 2026

September-25

M	T	W	T	F	S	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

October-25

M	T	W	T	F	S	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

November-25

M	T	W	T	F	S	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

December-25

M	T	W	T	F	S	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

January-26

M	T	W	T	F	S	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

February-26

M	T	W	T	F	S	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	

March-26

M	T	W	T	F	S	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

April-26

M	T	W	T	F	S	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

May-26

M	T	W	T	F	S	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

June-26

M	T	W	T	F	S	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

July-26

M	T	W	T	F	S	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

Key:

	Welcome meeting for new students
	School day
	Evaluation process
	Holiday
	Extraordinary exams
	Vacation
	Compensation for holidays, change of schedule

Enrollment dates:

1st and 2nd Semesters enrollment: 23-31 July and 4-12 September 2025

Unenrollment for 2nd Semester (max. 12 ECTS): 26-30 January 2026

Restricted extension of enrollment: 1-5 February 2026

NOTE: On Tuesday 11th November 2025, the classes will follow the schedule of a usual Monday in all courses and subjects, as a compensation for holidays
Compensation for holidays in the Spring semester to be defined when 2026 holidays are established

EMSE - First Semester (September-January)

	10:00-11:00	11:00-12:00	12:00-13:00	13:00-14:00	15:00-16:00	16:00-17:00	17:00-18:00	18:00-19:00	19:00-20:00	20:00-21:00
Monday	Programming of User Interfaces	Computer Security	User Experience and Mobile Interaction							
			Verification and Validation		Software Project Management					
Tuesday			Challenges for Accessible Computing for People with Functional Diversity		Software Metrics			Requirements Engineering		
Wednesday		E-Health: Promoting Active and Healthy Aging	Adaptive Systems		Models and Methods for Process Improvement and Assessment			Assessment Activities		
			Data Mining							
Thursday		Programming of User Interfaces	Software Engineering for Deep learning		Verification and Validation					
			Management, Relationships and Communication in Working Groups							
Friday					Agile Software Development: Agile Practices and Agile Usability		Requirements Engineering			

Mandatory Subjects

Elective Subjects

Elective Subjects with restricted enrolment (only if required upon admission)

Special Activities

Mandatory Subjects (weeks 1 to 7)

EMSE - Second Semester (February-May)

	12:00-13:00	13:00-14:00	15:00-16:00	16:00-17:00	17:00-18:00	18:00-19:00	19:00-20:00	20:00-21:00
Monday	Strategic Management and Entrepreneurship		Software Architecture		Software Design			
Tuesday			Software Quality Management		Experimental Software Engineering			
Wednesday				Correctness by Construction				
Thursday			Fundamentals of Business Administration		Assessment Activities			
			Experimental Software Engineering					
Friday								

 Mandatory Subjects
 Elective Subjects

 Elective Subjects (weeks 1 to 12)
 Special Activities

८५

JANUARY 2026													
MONDAY		TUESDAY		WEDNESDAY		THURSDAY		FRIDAY		SATURDAY		SUNDAY	
12		13		14		15		16		17		18	
Computer Security	11:00	Programming of User Inter- faces	12:00	E-Health: Promoting Active and Healthy Aging	12:00								
Verification and Validation	15:00	Software Metrics	15:00	Challenges for Accessible Computing for People with Functional Diversity	15:00			User Experi- ence and Mobile Inter- action	15:00				
Adaptive Systems	18:00					Software Project Man- agement	15:00	Agile Software Development: Agile Practices and Agile Usability	18:00				
19		20		21		22		23		24		25	
Models and Methods for Process Im- provement and Assess- ment	15:00	Requirements Engineering	15:00	Software Engineering for Deep Learning	15:00	Master Thesis	10:00						
Data Mining	18:00	Management, Relationships and Commu- nication in Working Groups	18:00										

2nd Semester (Spring Term)

JUNE 2026							
MONDAY		TUESDAY		WEDNESDAY		THURSDAY	
1		2		3		4	
		Software Design 15:00		Software Quality Management 15:00		Fundamentals of Business Administration 15:00	
5		Software Architecture 15:00					
6							
7							
8		9		10		11	
		Experimental Software Engineering 15:00		Correctness by Construction 15:00		Strategic Management and Entrepreneurship 15:00	
12		Master Thesis 10:00					
13							
14							

Extraordinary period (JUL)

JUNE-JULY 2026						
MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY
22	23	24	25	26	27	28
			Programming of User Interfaces 12:00			
		Software Design 15:00	Models and Methods for Process Improvement and Assessment 15:00	Verification and Validation 15:00		
		Data Mining 18:00	User Experience and Mobile Interaction 18:00	Adaptive Systems 18:00		
29	30	1	2	3	4	5
Computer Security 11:00			E-Health: Promoting Active and Healthy Aging 12:00			
Challenges for Accessible Computing for People with Functional Diversity 15:00	Software Metrics 15:00	Software Architecture 15:00	Requirements Engineering 15:00	Correctness by Construction 15:00		
Agile Software Development: Agile Practices and Agile Usability 18:00	Software Quality Management 18:00	Management, Relationships and Communication in Working Groups 18:00	Experimental Software Engineering 18:00			
6	7	8	9	10	11	12
Software Project Management 15:00	Fundamentals of Business Administration 15:00	Strategic Management and Entrepreneurship 15:00		Master Thesis 10:00		
	Software Engineering for Deep Learning 18:00					

5 Courses Coordinators

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Subjects for Course 2025/2026

MODULE SOFTWARE DEVELOPMENT				
Course unit name	Coordinator	Type	ECTS	Term
Requirements Engineering	Óscar Dieste	C	6	1, 3
Software Architecture	Pilar Rodríguez	C	4	2
Software Design	Jaime Ramírez	C	4	2

MODULE PROJECT MANAGEMENT AND ORGANIZATIONAL PROCESSES				
Course unit name	Coordinator	Type	ECTS	Term
Models and Methods for Process Improvement and Assessment	José A. Calvo-Manzano	C	4	1, 3
Software Project Management	Ana M. Moreno	C	4	1, 3

MODULE SUPPORT PROCESSES				
Course unit name	Coordinator	Type	ECTS	Term
Software Metrics	Tomás San Feliu	C	4	1, 3
Software Quality Management	Angélica de Antonio	C	4	2
Verification and Validation	Sira Vegas	C	6	1, 3

MODULE ADVANCED SOFTWARE ENGINEERING ASPECTS				
Course unit name	Coordinator	Type	ECTS	Term
Adaptive Systems	Jaime Ramírez	E	4	1, 3
Agent-based Software Development	Ricardo Imbert	E	6	2
Agile Software Development: Agile Practices and Agile Usability	Ana M. Moreno	E	4	1, 3
Challenges for Accessible Computing for People with Functional Diversity	José Luis Fuertes	E	4	1, 3
Computer Security	Manuel Carro	E	4	1, 3
Correctness by Construction	Manuel Carro	E	6	2
Data Mining	Javier Segovia	E	4	1, 3
E-Health: Promoting Active and Healthy Aging	Elena Villalba	E	4	1
Experimental Software Engineering	Sira Vegas	E	6	2
Fundamentals of Business Administration	José N. Franco-Riquelme	E	4	2
Management, Relationships and Communication in Working Groups	Susana Muñoz	E	4	1, 3
Programming of User Interfaces	Raúl Alonso	E	6	1,3
Software Engineering for Deep Learning	Sira Vegas	E	4	1
Strategic Management and Entrepreneurship	Claudio Feijoo	E	4	2
User Experience and Mobile Interaction	Ricardo Imbert	E	6	1,3

PRACTICUM				
Course unit name	Coordinator	Type	ECTS	Term
Software Project	Pilar Rodríguez	C	14	3, 4

FINAL MASTER THESIS				
Course unit name	Coordinator	Type	ECTS	Term
Master Thesis	Óscar Dieste	C	30	3, 4

Type: C - Compulsory; E - Elective

6 Courses Boards

Máster Universitario en Ingeniería del Software European Master in Software Engineering

Evaluation Boards for Course 2025/2026

SUBJECT	PRESIDENT	VOCAL	SECRETARY	SUBSTITUTE
Adaptive Systems	Jaime Ramírez	Angélica de Antonio	Ricardo Imbert	Elena Villalba
Agent-based Software Development	Ricardo Imbert	Jose María Barambones	Jaime Ramírez	Angélica de Antonio
Agile Software Development: Agile Practices and Agile Usability	Ana María Moreno	José A. Calvo-Manzano	Tomás San Feliu	Jaime Ramírez
Challenges for Accessible Computing for People with Functional Diversity	José Luis Fuertes	Loïc Martínez	Angélica de Antonio	Jaime Ramírez
Computer Security	Manuel Carro	Julio Mariño	Lars-Åke Fredlund	Jaime Ramírez
Correctness by Construction	Manuel Carro	Guillermo Román	Clara Benac	Jaime Ramírez
Data Mining	Javier Segovia	Ernestina Menasalvas	Alejandro Rodríguez	Jaime Ramírez
E-Health: Promoting Active and Healthy Ageing	Elena Villalba	Cristian Moral	Angélica de Antonio	Jaime Ramírez
Experimental Software Engineering	Sira Vegas	Pilar Rodríguez	Óscar Dieste	Jaime Ramírez
Fundamentals of Business Administration	José N. Franco Riquelme	Raúl Gutiérrez	Jaime Ramírez	Angélica de Antonio
Management, Relationships and Communication in Working Groups	Susana Muñoz	Julio Mariño	Lars-Åke Fredlund	Jaime Ramírez
Master Thesis	Óscar Dieste	Jaime Ramírez	Angélica de Antonio	Pilar Rodríguez
Models and Methods for Process Improvement and Assessment	José A. Calvo-Manzano	Tomás San Feliu	Ricardo Imbert	Jaime Ramírez
Programming of User Interfaces	Guillermo Román	Raúl Alonso	Ángel Lucas González	Jaime Ramírez
Requirements Engineering	Óscar Dieste	Pilar Rodríguez	Sira Vegas	Jaime Ramírez
Seminars	Jaime Ramírez	Ricardo Imbert	Óscar Dieste	Angélica de Antonio
Software Architecture	Pilar Rodríguez	Jaime Ramírez	Angélica de Antonio	Tomás San Feliu
Software Design	Jaime Ramírez	Sira Vegas	Ricardo Imbert	Angélica de Antonio
Software Engineering for Deep Learning	Sira Vegas	Pilar Rodríguez	Óscar Dieste	Jaime Ramírez
Software Metrics	Tomás San Feliu	José A. Calvo-Manzano	Ricardo Imbert	Jaime Ramírez
Software Project (Practicum)	Pilar Rodríguez	Ricardo Imbert	Ana María Moreno	Jaime Ramírez
Software Project Management	Ana María Moreno	Sira Vegas	Tomás San Feliu	Jaime Ramírez
Software Quality Management	Angélica de Antonio	Sira Vegas	Ricardo Imbert	Jaime Ramírez
Strategic Management & Entrepreneurship	Claudio Feijoo	Javier Segovia	Angélica de Antonio	Jaime Ramírez
User Experience and Mobile Interaction	Ricardo Imbert	Elena Villalba	Loïc Martínez	Jaime Ramírez
Verification and Validation	Sira Vegas	Pilar Rodríguez	Óscar Dieste	Jaime Ramírez

7 Master Thesis Regulations

European Master in Software Engineering

Master's Thesis Procedure

The Master's Thesis is a 30 ECTS individual project that synthesizes the skills acquired in the Software Engineering program. It consists of the following:

- Individual execution of a development project or applied research work in Software Engineering.
- Prepare a dissertation.
- Presentation and defense in English before an examination Board composed of EMSE Faculty.

Students will be assigned a Master's Thesis supervisor to help plan and oversee the work through regular meetings. Supervisors will also help students prepare the thesis document and the public defense.

The Master's Thesis can be carried out:

- In a university different than UPM.
- In a research center.
- In the organization where students completed the Software Project subject, taking the work performed as a starting point.

In these cases, the student must have at least one UPM professor participating in the Master as supervisor. In the latter case, students should also request the authorization of the Master's Thesis coordinator.

The Master's Thesis work is composed of three phases:

- 1st Phase: Selection of theme and director
- 2nd Phase: Completion of the Master's Thesis
- 3rd Phase: Defense of the Master's Thesis

Phase 1: Choice of topic and supervisor

There is a space in the Virtual Classroom (Moodle) called "Master's Thesis," to which students enrolled in the Master's Thesis subject have access.

A compilation of Master's Thesis proposals offered by the EMSE Faculty, together with a description and previous advisable knowledge, is listed in this space during October.

When students find a proposal of interest, they shall contact the proponent professor, and the professor will decide whom of the interested students the proposal will be assigned to. Alternatively, when students have a particular topic of interest not

considered in the list of proposals, they are encouraged to contact any Master's professor interested in supervising such a proposal.

In both cases, once agreed upon with a professor, the student shall send the Master's administrative secretary the [document of assignation of the Master's Thesis](#), signed by the student and the professor, who will be, from that moment, the Master's Thesis supervisor.

The Master's Thesis can have a co-supervisor; in that case, the co-supervisor shall also sign this document.

The supervisor's mission shall focus on putting students into contact with the appropriate third parties, providing guidance on the background information, advising the execution, appraising the work progress, coming up with ideas for consideration, revising documentation written by students, etc.

Phase 2: Completion of Master Thesis

The Master's Thesis involves the Master's degree candidate writing a dissertation. The topic and approach may be diverse. It shall deal with original work in Software Engineering with a clear structure and properly conducted, described, and justified.

The supervisor shall guide the student to ensure the proper nature and format of the work. Students must demonstrate that they have developed skills to carry out a development project or an applied research work, always in Software Engineering.

Minor restrictions have been imposed regarding the structure and length of the Master's Thesis. The supervisor shall establish them depending on the nature and contents of the work. Nevertheless, it is important to respect the format specified in the following [Master's Thesis template](#).

Phase 3: Defense of Master Thesis

Students are entitled to defend their Master's Thesis at the date indicated in the Examination Timetable. For this purpose, the student shall submit to the [administrative secretary](#), either on paper or by email, the [document of application for the defense of the Master's Thesis](#) filled out and signed. **This application shall be submitted at least 20 days before the defense date.** If the application is correct and the student is enrolled in the Master's Thesis subject, the administrative secretary will communicate to the student that his/her defense application has been accepted.

Additionally, the administrative secretary or the Master's Thesis coordinator will provide the student with two forms: one for [authorizing the online publication of the Master's Thesis report](#) and the other for [stating the confidentiality or not of this document](#). If students authorize the online publication of their reports, they shall fill out and sign both forms. Otherwise, they shall fill out and sign the confidentiality form only.

The student should have completed 90 ECTS before defending the Master Thesis or complete these 90 ECTS in the same examination batch where the Thesis is defended.

Students shall then email the [administrative secretary](#) a **PDF version of their dissertations and the required forms correctly filled out and signed at least 7 working days before the date of the Master's Thesis defense**. It is not necessary to submit or print any hard copy of the Master's Thesis.

Students shall defend their Master's Thesis individually in a public oral hearing before a board appointed by the Master's Thesis coordinator. The Board shall be composed of three EMSE Faculty Members.

All Master Theses will be defended in a single session, except when the number of Master's Theses to be defended is so high that it would be advisable to hold parallel defense sessions. Nobody else but the master candidate and the Board are expected to participate actively in the defense process.

The Board shall follow the following instructions, which rule the protocol for defending the Master's Thesis:

1. Once the candidate is ready, the Chairman will announce the beginning of the defense, reading the title of the work and the name of the author and supervisor(s).
2. The student shall deliver a 20-minute oral presentation to the Board, focused on showing the nature and results of the work.
3. After the student presentation, the Chairman will give way to the Board questions round. Board members can raise any question, query, clarification, or objection they like, to which students shall have to give proper and convincing responses.

After receiving all the evaluations from the supervisors and Board members for each Master's Thesis, the final grades will be published.

8 Learning Guides

8.1 Software Development Module

8.1.1 Requirements Engineering



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GUÍA DE APRENDIZAJE

ASIGNATURA

103000482 - Requirements Engineering

PLAN DE ESTUDIOS

10AM - Master Universitario En Ingeniería Del Software

CURSO ACADÉMICO Y SEMESTRE

2025/26 - Primer semestre



Índice

Guía de Aprendizaje

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1. Datos descriptivos

1.1. Datos de la asignatura

Nombre de la asignatura	103000482 - Requirements Engineering
No de créditos	6 ECTS
Carácter	Obligatoria
Curso	Primer curso
Semestre	Primer semestre
Período de impartición	Septiembre-Enero
Idioma de impartición	Inglés/Castellano
Titulación	10AM - Master Universitario en Ingeniería del Software
Centro responsable de la titulación	10 - E.T.S. De Ingenieros Informáticos
Curso académico	2025-26

2. Profesorado

2.1. Profesorado implicado en la docencia

Nombre	Despacho	Correo electrónico	Horario de tutorías *
Oscar Dieste Tubio (Coordinador/a)	D-5106	oscar.dieste@upm.es	V - 11:00 - 17:00
Natalia Juristo Juzgado	D-5104	natalia.juristo@upm.es	Sin horario. El horario de tutorías está disponible en Moodle.

* Las horas de tutoría son orientativas y pueden sufrir modificaciones. Se deberá confirmar los horarios de tutorías con el profesorado.

3. Competencias y resultados de aprendizaje

3.1. Competencias

CE5 - Educir, analizar y especificar las necesidades de los clientes, usuarios y otras partes interesadas, teniendo en cuenta los posibles condicionantes que pudieran afectar al sistema a desarrollar

CG1 - Que los estudiantes sepan aplicar los conocimientos adquiridos y su capacidad de resolución de problemas en entornos nuevos o poco conocidos dentro de contextos más amplios (o multidisciplinares) relacionados con su área de estudio (RD)

CG3 - Que los estudiantes sepan comunicar sus conclusiones y los conocimientos y razones últimas que las sustentan a públicos especializados y no especializados de un modo claro y sin ambigüedades (RD)

3.2. Resultados del aprendizaje

RA74 - The students will be able to analyze, specify and validate software requirements

RA75 - The students will be able to manage and negotiate requirements with project stakeholders

RA73 - The students will be able to elicit and conceptualize customer and user's needs

4. Descripción de la asignatura y temario

4.1. Descripción de la asignatura

The requirements engineering course aims to enhance students' skills in software requirements, encompassing elicitation, analysis, documentation, validation, and management. The course will balance lectures and practical activities. Special attention will be paid to tool support.



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4.2. Temario de la asignatura

1. Requirements engineering processes

1.1. Lifecycle and process models

1.1.1. IEEE/ISO/IEC 12207-2017 Software life cycle processes

1.1.2. IEEE/ISO/IEC 29148-2018 Life cycle processes -- Requirements engineering

1.2. System operational concept

1.3. Concept of operations

1.4. Business requirements Specification

1.5. Stakeholder requirements specification

1.6. System requirements specification

2. Requirements elicitation

2.1. Process actors

2.2. Requirements sources

2.3. Elicitation techniques

2.3.1. Interviews

2.3.2. Scenarios

2.3.3. Regular techniques: observation, competing analysis, document analysis, focus groups, brainstorming

2.3.4. Contrived techniques: Laddering, card sorting, protocol analysis

2.3.5. Elicitation technique selection

3. Requirements analysis

3.1. Glossaries

3.2. Weak techniques: analysis checklist, interaction matrix

4. Requirements documentation

4.1. Requirements

4.1.1. Types

4.1.1.1. Non-functional requirements

4.1.2. Properties



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- 4.2. User stories
- 4.3. Use cases
- 4.4. Software requirements specification
 - 4.4.1. Specification properties
 - 4.4.2. Templates
- 4.5. Traceability
- 4.6. Requirements tools
 - 4.6.1. Jira-like tools
 - 4.6.2. DOORS Next Generation
- 5. Requirements validation
 - 5.1. Requirement reviews
 - 5.2. Prototyping
 - 5.3. Requirements testing
 - 5.4. User manual development
- 6. Requirements management/release planning
 - 6.1. Prioritization
 - 6.2. Effort and cost estimation
 - 6.3. Change management
 - 6.4. Release planning



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5. Cronograma

5.1. Cronograma de la asignatura *

Sem	Actividad tipo 1	Actividad tipo 2	Tele-enseñanza	Actividades de evaluación
1	Course goals and methodology Duración: 00:30 LM: Actividad del tipo Lección Magistral Requirements Engineering: Process Duración: 00:30 LM: Actividad del tipo Lección Magistral Requirements: Concept and types Duración: 01:00 AC: Actividad del tipo Acciones Cooperativas Requirements: Use cases Duración: 01:00 AC: Actividad del tipo Acciones Cooperativas			
2	How to write software requirements Duración: 01:00 AC: Actividad del tipo Acciones Cooperativas Software requirements specifications Duración: 01:00 LM: Actividad del tipo Lección Magistral Tool support for requirements specification: DOORS Next Generation Duración: 01:00 PL: Actividad del tipo Prácticas de Laboratorio			Identify software requirements for an existing software system TI: Técnica del tipo Trabajo Individual Evaluación Progresiva No presencial Duración: 01:00 PROJECT: Software project proposal TG: Técnica del tipo Trabajo en Grupo Evaluación Progresiva No presencial Duración: 01:00
3	Requirements Engineering: Importance Duración: 00:30 LM: Actividad del tipo Lección Magistral Requirements verification and validation Duración: 00:30 LM: Actividad del tipo Lección Magistral Requirements reviews Duración: 01:00 AC: Actividad del tipo Acciones Cooperativas Other validation approaches: Requirements testing and user manual development Duración: 01:00 AC: Actividad del tipo Acciones Cooperativas			Creation of a requirements specification using DOORS TI: Técnica del tipo Trabajo Individual Evaluación Progresiva No presencial Duración: 03:00



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4	Requirements elicitation: Introduction Duración: 00:30 LM: Actividad del tipo Lección Magistral Requirements elicitation: Interviews Duración: 00:30 LM: Actividad del tipo Lección Magistral Interview scripts Duración: 01:00 AC: Actividad del tipo Acciones Cooperativas Vision & Scope document Duración: 01:00 AC: Actividad del tipo Acciones Cooperativas			Apply requirements testing and user manual development TI: Técnica del tipo Trabajo Individual Evaluación Progresiva No presencial Duración: 02:00 PROJECT: Software project definition TG: Técnica del tipo Trabajo en Grupo Evaluación Progresiva No presencial Duración: 05:00
5	PROJECT: Conduct the first interview Duración: 02:00 AC: Actividad del tipo Acciones Cooperativas Midterm exam Duración: 01:00 OT: Otras actividades formativas / Evaluación			Midterm exam EX: Técnica del tipo Examen Escrito Evaluación Progresiva Presencial Duración: 01:00
6	Prototyping Duración: 01:00 LM: Actividad del tipo Lección Magistral PROJECT: Conduct the second interview Duración: 02:00 AC: Actividad del tipo Acciones Cooperativas			PROJECT: Create a Vision & Scope document (on DOORS) TG: Técnica del tipo Trabajo en Grupo Evaluación Progresiva No presencial Duración: 03:00
7	Elicitation: Observation Duración: 00:20 AC: Actividad del tipo Acciones Cooperativas Elicitation: Competing product analysis Duración: 00:40 AC: Actividad del tipo Acciones Cooperativas Brainstorming Duración: 01:00 AC: Actividad del tipo Acciones Cooperativas Delphi Duración: 01:00 AC: Actividad del tipo Acciones Cooperativas			PROJECT: Create a user-oriented specification document (use cases) (on DOORS) TG: Técnica del tipo Trabajo en Grupo Evaluación Progresiva No presencial Duración: 04:00 PROJECT: Create a low fidelity prototype TG: Técnica del tipo Trabajo en Grupo Evaluación Progresiva No presencial Duración: 02:00
8	Elicitation: Surveys Duración: 01:00 AC: Actividad del tipo Acciones Cooperativas PROJECT: Perform the evaluation of the project's low-fidelity prototype Duración: 02:00 AC: Actividad del tipo Acciones			



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	Cooperativas			
9	Elicitation: Document analysis Duración: 00:30 AC: Actividad del tipo Acciones Cooperativas Elicitation: Focus groups Duración: 02:00 AC: Actividad del tipo Acciones Cooperativas Elicitation: Technique selection Duración: 00:30 AC: Actividad del tipo Acciones Cooperativas			PROJECT: Update the user-oriented specification document (use cases) (on DOORS) TG: Técnica del tipo Trabajo en Grupo Evaluación Progresiva No presencial Duración: 01:00
10	Elicitation: Requirements workshops Duración: 00:30 LM: Actividad del tipo Lección Magistral User cases and requirements Duración: 00:30 LM: Actividad del tipo Lección Magistral PROJECT: Perform a requirements workshop Duración: 02:00 AC: Actividad del tipo Acciones Cooperativas			
11	Triage and release planning Duración: 00:30 LM: Actividad del tipo Lección Magistral Requirements prioritization Duración: 00:30 LM: Actividad del tipo Lección Magistral Early estimation Duración: 02:00 PR: Actividad del tipo Clase de Problemas			PROJECT: Create a software requirements specification (on DOORS) TG: Técnica del tipo Trabajo en Grupo Evaluación Progresiva No presencial Duración: 05:00
12	PROJECT: Perform a requirements review Duración: 02:00 AC: Actividad del tipo Acciones Cooperativas Midterm exam Duración: 01:00 OT: Otras actividades formativas / Evaluación			Midterm exam EX: Técnica del tipo Examen Escrito Evaluación Progresiva Presencial Duración: 01:00 PROJECT: Report the requirements review TG: Técnica del tipo Trabajo en Grupo Evaluación Progresiva No presencial Duración: 02:00
13	PROJECT: Prioritize requirements Duración: 00:30 AC: Actividad del tipo Acciones Cooperativas PROJECT: Estimate cost and effort Duración: 01:30 AC: Actividad del tipo Acciones Cooperativas Perform a triage process			PROJECT: Update the software requirements specification (on DOORS) TG: Técnica del tipo Trabajo en Grupo Evaluación Progresiva No presencial Duración: 01:00 Report the triage process TG: Técnica del tipo Trabajo en Grupo Evaluación Progresiva No presencial



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	Duración: 01:00 AC: Actividad del tipo Acciones Cooperativas			Duración: 03:00
14	Requirements management Duración: 01:00 LM: Actividad del tipo Lección Magistral Paper presentation Duración: 02:00 OT: Otras actividades formativas / Evaluación			
15	Paper presentation Duración: 02:00 OT: Otras actividades formativas / Evaluación End-term exam Duración: 01:00 OT: Otras actividades formativas / Evaluación			End-term exam EX: Técnica del tipo Examen Escrito Evaluación Progresiva Presencial Duración: 01:00 Paper writing and presentation PG: Técnica del tipo Presentación en Grupo Evaluación Progresiva Presencial Duración: 00:00
16				
17	Global examination / resit Duración: 03:00 OT: Otras actividades formativas / Evaluación			Global examination / resit EX: Técnica del tipo Examen Escrito Evaluación Global Presencial Duración: 03:00

Para el cálculo de los valores totales, se estima que por cada crédito ECTS el alumno dedicará dependiendo del plan de estudios, entre 26 y 27 horas de trabajo presencial y no presencial.



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6. Actividades y criterios de evaluación

6.1. Actividades de evaluación de la asignatura

6.1.1. Evaluación (progresiva)

Sem.	Descripción	Modalidad	Tipo	Duración	Peso en la nota	Nota mínima	Competencias evaluadas
2	Identify software requirements for an existing software system	TI: Técnica del tipo Trabajo Individual	No Presencial	01:00	2%	3 / 10	CE5
2	PROJECT: Software project proposal	TG: Técnica del tipo Trabajo en Grupo	No Presencial	01:00	2%	3 / 10	CG1 CE5 CG3
3	Creation of a requirements specification using DOORS	TI: Técnica del tipo Trabajo Individual	No Presencial	03:00	4%	3 / 10	CE5
4	Apply requirements testing and user manual development	TI: Técnica del tipo Trabajo Individual	No Presencial	02:00	2%	3 / 10	CE5
4	PROJECT: Software project definition	TG: Técnica del tipo Trabajo en Grupo	No Presencial	05:00	8%	3 / 10	CE5 CG3
5	Midterm exam	EX: Técnica del tipo Examen Escrito	Presencial	01:00	10%	3 / 10	CE5
6	PROJECT: Create a Vision & Scope document (on DOORS)	TG: Técnica del tipo Trabajo en Grupo	No Presencial	03:00	5%	3 / 10	CG1 CE5 CG3
7	PROJECT: Create a user-oriented specification document (use cases) (on DOORS)	TG: Técnica del tipo Trabajo en Grupo	No Presencial	04:00	8%	3 / 10	CG1 CE5 CG3



7	PROJECT: Create a low fidelity prototype	TG: Técnica del tipo Trabajo en Grupo	No Presencial	02:00	3%	3 / 10	CG1 CE5
9	PROJECT: Update the user-oriented specification document (use cases) (on DOORS)	TG: Técnica del tipo Trabajo en Grupo	No Presencial	01:00	2%	3 / 10	CG1 CE5 CG3
11	PROJECT: Create a software requirements specification (on DOORS)	TG: Técnica del tipo Trabajo en Grupo	No Presencial	05:00	10%	3 / 10	CG1 CE5 CG3
12	Midterm exam	EX: Técnica del tipo Examen Escrito	Presencial	01:00	10%	3 / 10	CE5
12	PROJECT: Report the requirements review	TG: Técnica del tipo Trabajo en Grupo	No Presencial	02:00	4%	3 / 10	CG1 CE5 CG3
13	PROJECT: Update the software requirements specification (on DOORS)	TG: Técnica del tipo Trabajo en Grupo	No Presencial	01:00	2%	3 / 10	CG1 CE5 CG3
13	Report the triage process	TG: Técnica del tipo Trabajo en Grupo	No Presencial	03:00	8%	3 / 10	CE5
15	End-term exam	EX: Técnica del tipo Examen Escrito	Presencial	01:00	10%	3 / 10	CE5
15	Paper writing and presentation	PG: Técnica del tipo Presentación en Grupo	Presencial	00:00	10%	3 / 10	CG1 CG3

6.1.2. Prueba evaluación global

Sem	Descripción	Modalidad	Tipo	Duración	Peso en la nota	Nota mínima	Competencias evaluadas
17	Global examination / resit	EX: Técnica del tipo Examen Escrito	Presencial	03:00	100%	5 / 10	CG3 CG1 CE5

6.1.3. Evaluación convocatoria extraordinaria



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Descripción	Modalidad	Tipo	Duración	Peso en la nota	Nota mínima	Competencias evaluadas
Final exam (extraordinary session)	EX: Técnica del tipo Examen Escrito	Presencial	03:00	100%	5 / 10	CG1 CE5 CG3

6.2. Criterios de evaluación

Progressive evaluation

- The assessment of assignments will depend on (1) the quality of the submissions, e.g., presentation, cleanliness, etc., and (2) the correctness of the results.
- The final grade will be calculated using a weighted average, as described before. The passing grade is 5.0.
- The laboratory cooperative activities labeled **"PROJECT:"** are compulsory. Skipping these activities without a valid reason implies failing the project.
- The course project-related activities are labeled **"PROJECT:"**. The students cannot retake the course project in the global evaluation. The project requires the cooperation of student groups and has a pre-specified calendar, including face-to-face sessions. These activities cannot be scheduled at different times because fellow students are not guaranteed to have other time slots available besides those assigned to the Requirements Engineering course.

Global evaluation (January)

- All assignments can be resubmitted and regraded. When the instructors provide feedback, they will specify a deadline for resubmission.
- The students can resit the midterm exams in January (on the date/time specified by the administration).

Global evaluation (July)

- Students will take a single exam. This exam includes all topics (theoretical and practical) covered in the course. Preparatory materials will be available on Moodle.



7. Recursos didácticos

7.1. Recursos didácticos de la asignatura

Nombre	Tipo	Observaciones
Course material	Recursos web	All required materials will be available on Moodle
Textbook	Bibliografía	Wieggers, Karl, and Beatty, Joy. Software Requirements. United States, Pearson Education, 2013. https://learning.oreilly.com/library/view/software-requirements-3rd/9780735679658/

8. Otra información

8.1. Otra información sobre la asignatura

This course will apply the Flipped Classroom methodology to selected topics. The goal is to enhance the students' learning experience, holding them accountable for acquiring foundational knowledge. The Flipped Classroom methodology will also save teaching time, allowing for more practical activities in the classroom.

8.1.2 Software Architecture



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LEARNING GUIDE

SUBJECT

103000484 - Software Architecture

DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

ACADEMIC YEAR & SEMESTER

2025/26 - Semester 2



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1. Description

1.1. Subject details

Name of the subject	103000484 - Software Architecture
No of credits	4 ECTS
Type	Compulsory
Academic year of the programme	First year
Semester of tuition	Semester 2
Tuition period	February-June
Tuition languages	English
Degree programme	10AM - Master Universitario en Ingeniería del Software
Centre	10 - E.T.S. De Ingenieros Informáticos
Academic year	2025-26

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Jaime Ramirez Rodriguez	5112	jaime.ramirez@upm.es	Sin horario. His tutoring timetable will be available on the Moodle site of the subject
Maria Pilar Rodriguez Gonzalez (Subject coordinator)	6203	pilar.rodriguez@upm.es	Sin horario. The tutoring timetable is available at: http://disis.fi.upm.es/tutoria



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s-2526

* The tutoring schedule is indicative and subject to possible changes. Please check tutoring times with the faculty member in charge.

3. Prior knowledge recommended to take the subject

3.1. Recommended (passed) subjects

The subject - recommended (passed), are not defined.

3.2. Other recommended learning outcomes

- Object oriented design

4. Skills and learning outcomes *

4.1. Skills to be learned

CE12 - Concebir y realizar el diseño de los sistemas software asegurando atributos relevantes de calidad.

CG1 - Que los estudiantes sepan aplicar los conocimientos adquiridos y su capacidad de resolución de problemas en entornos nuevos o poco conocidos dentro de contextos más amplios (o multidisciplinares) relacionados con su área de estudio (RD)

CG14 - Conocimiento y comprensión de la informática necesaria para la creación de modelos de información, y de los sistemas y procesos complejos

CG18 - Capacidad de trabajar y comunicarse también en contextos internacionales

CG3 - Que los estudiantes sepan comunicar sus conclusiones y los conocimientos y razones últimas que las sustentan a públicos especializados y no especializados de un modo claro y sin ambigüedades (RD)



4.2. Learning outcomes

RA4 - To design the system according to the requirements, constraints, quality norms and organization goals.

RA6 - Ability to document the software architecture

RA5 - To apply the architectural concepts that are relevant in the architectural design

* The Learning Guides should reflect the Skills and Learning Outcomes in the same way as indicated in the Degree Verification Memory. For this reason, they have not been translated into English and appear in Spanish.

5. Brief description of the subject and syllabus

5.1. Brief description of the subject

The goal of the subject is to teach the basis of the software architectural design. For that purpose, it will be shown how the quality attribute requirements of the system can be satisfied by applying some tactics. In addition, architectural styles will be addressed and their relationship with quality attributes will be explained. Then, some representative architectural patterns will be explained showing how they can be reused to solve some design problems providing well proven solutions without the need of re-inventing the wheel. Throughout the course, application examples will be briefly described to illustrate the concepts.

5.2. Syllabus

1. Previous Concepts on Software Architecture
2. Defining a Software Architecture
 - 2.1. Quality Attributes related to Software Architecture
 - 2.2. Achieving Quality Attributes through Tactics
 - 2.3. Architectural Views
 - 2.4. Architectural Styles
 - 2.5. Architectural Patterns



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6. Schedule

6.1. Subject schedule*

Week	Type 1 activities	Type 2 activities	Distant / On-line	Assessment activities
1	Presentación Duration: 01:00 Lecture Previous concepts on Software Architecture Duration: 01:00 Lecture			Classroom participation grade Other assessment Progressive assessment Presential Duration: 00:00
2	Quality attributes related to software architecture Duration: 01:00 Lecture Practical exercises on topics that are being explained in classroom Duration: 01:00 Cooperative activities			Classroom participation grade Other assessment Progressive assessment Presential Duration: 00:00
3	Practical exercises on topics that are being explained in classroom Duration: 01:00 Cooperative activities Achieving quality attributes through tactics Duration: 01:00 Lecture			Practical exercises on topics that are being explained in classroom Group work Progressive assessment Not Presential Duration: 03:00 Classroom participation grade Other assessment Progressive assessment Presential Duration: 00:00
4	Achieving quality attributes through tactics Duration: 01:00 Lecture Practical exercises on topics that are being explained in classroom Duration: 01:00 Cooperative activities			Classroom participation grade Other assessment Progressive assessment Presential Duration: 00:00
5	Architectural views Duration: 01:00 Lecture Practical exercises on topics that are being explained in classroom Duration: 01:00 Cooperative activities			Classroom participation grade Other assessment Progressive assessment Presential Duration: 00:00



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6	Practical exercises on topics that are being explained in classroom Duration: 01:00 Cooperative activities Architectural styles Duration: 01:00 Lecture			Classroom participation grade Other assessment Progressive assessment Presential Duration: 00:00
7	Architectural styles Duration: 01:00 Lecture Practical exercises on topics that are being explained in classroom Duration: 01:00 Cooperative activities			Practical exercises on topics that are being explained in classroom Group work Progressive assessment Not Presential Duration: 05:00 Classroom participation grade Other assessment Progressive assessment Presential Duration: 00:00
8	Architectural styles Duration: 01:00 Lecture Practical exercises on topics that are being explained in classroom Duration: 01:00 Cooperative activities			Classroom participation grade Other assessment Progressive assessment Presential Duration: 00:00
9	Practical exercises on topics that are being explained in classroom Duration: 01:00 Cooperative activities Architectural patterns Duration: 01:00 Lecture			Practical exercises on topics that are being explained in classroom Group work Progressive assessment Not Presential Duration: 05:00 Classroom participation grade Other assessment Progressive assessment Presential Duration: 00:00
10	Practical exercises on topics that are being explained in classroom Duration: 01:00 Cooperative activities Architectural patterns Duration: 01:00 Lecture			Classroom participation grade Other assessment Progressive assessment Presential Duration: 00:00
11	Presentations of the project proposals Duration: 01:00 Additional activities Architectural patterns Duration: 01:00 Lecture			Project Group work Progressive assessment Not Presential Duration: 05:00 Classroom participation grade Other assessment Progressive assessment Presential Duration: 00:00



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12	Architectural patterns Duration: 01:00 Lecture Practical exercises on topics that are being explained in classroom Duration: 01:00 Cooperative activities			Project Group work Progressive assessment Not Presential Duration: 05:00 Classroom participation grade Other assessment Progressive assessment Presential Duration: 00:00
13	Architectural patterns Duration: 01:00 Lecture Practical exercises on topics that are being explained in classroom Duration: 01:00 Cooperative activities			Project Group work Progressive assessment Not Presential Duration: 05:00 Classroom participation grade Other assessment Progressive assessment Presential Duration: 00:00
14	Oral presentations of the projects Duration: 02:00 Additional activities Oral presentations of the projects Duration: 02:00 Additional activities			Project Group work Progressive assessment Not Presential Duration: 09:00 Classroom participation grade Other assessment Progressive assessment Presential Duration: 00:00
15	Exam Duration: 02:00 Additional activities			Exam Written test Progressive assessment Presential Duration: 02:00 Classroom participation grade Other assessment Progressive assessment Presential Duration: 00:00
16				Final Exam Written test Global examination Presential Duration: 01:00
17				

Depending on the programme study plan, total values will be calculated according to the ECTS credit unit as 26/27 hours of student face-to-face contact and independent study time.



7. Activities and assessment criteria

7.1. Assessment activities

7.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
1	Classroom participation grade	Other assessment	Face-to-face	00:00	.33%	0 / 10	CE12 CG14 CG18 CG1 CG3
2	Classroom participation grade	Other assessment	Face-to-face	00:00	.33%	0 / 10	CE12 CG14 CG18 CG1 CG3
3	Practical exercises on topics that are being explained in classroom	Group work	No Presential	03:00	5%	0 / 10	CE12
3	Classroom participation grade	Other assessment	Face-to-face	00:00	.33%	0 / 10	CE12 CG14 CG18 CG1 CG3
4	Classroom participation grade	Other assessment	Face-to-face	00:00	.33%	0 / 10	CE12 CG14 CG18 CG1 CG3
5	Classroom participation grade	Other assessment	Face-to-face	00:00	.33%	0 / 10	CE12 CG14 CG18 CG1 CG3
6	Classroom participation grade	Other assessment	Face-to-face	00:00	.33%	0 / 10	CE12 CG14 CG18 CG1 CG3
7	Practical exercises on topics that are being explained in classroom	Group work	No Presential	05:00	10%	0 / 10	CE12



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7	Classroom participation grade	Other assessment	Face-to-face	00:00	.33%	0 / 10	CE12 CG14 CG18 CG1 CG3
8	Classroom participation grade	Other assessment	Face-to-face	00:00	.33%	0 / 10	CE12 CG14 CG18 CG1 CG3
9	Practical exercises on topics that are being explained in classroom	Group work	No Presential	05:00	10%	0 / 10	CE12
9	Classroom participation grade	Other assessment	Face-to-face	00:00	.33%	0 / 10	CE12 CG14 CG18 CG1 CG3
10	Classroom participation grade	Other assessment	Face-to-face	00:00	.33%	0 / 10	CE12 CG14 CG18 CG1 CG3
11	Project	Group work	No Presential	05:00	10%	5 / 10	CE12 CG14 CG18 CG1 CG3
11	Classroom participation grade	Other assessment	Face-to-face	00:00	.33%	0 / 10	CE12 CG14 CG18 CG1 CG3
12	Project	Group work	No Presential	05:00	10%	5 / 10	
12	Classroom participation grade	Other assessment	Face-to-face	00:00	.33%	0 / 10	CE12 CG14 CG18 CG1 CG3
13	Project	Group work	No Presential	05:00	10%	5 / 10	CE12 CG14 CG18 CG1 CG3
13	Classroom participation grade	Other assessment	Face-to-face	00:00	.33%	0 / 10	CE12 CG14 CG18 CG1 CG3



14	Project	Group work	No Presential	09:00	15%	5 / 10	CE12 CG14 CG18 CG1 CG3
14	Classroom participation grade	Other assessment	Face-to-face	00:00	.33%	0 / 10	CE12 CG14 CG18 CG1 CG3
15	Exam	Written test	Face-to-face	02:00	25%	4 / 10	CE12
15	Classroom participation grade	Other assessment	Face-to-face	00:00	.38%	0 / 10	

7.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
16	Final Exam	Written test	Face-to-face	01:00	25%	5 / 10	CE12 CG14 CG18 CG1 CG3

7.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Project	Individual work	Face-to-face	00:00	75%	5 / 10	CE12 CG14 CG18 CG1 CG3
Final Exam	Individual work	Face-to-face	00:00	25%	5 / 10	CE12 CG14 CG1 CG3



7.2. Assessment criteria

1. Regular Period

1.1. Distributed evaluation

Throughout the semester, in order to pass the course, the student will have to do the following assignments:

- Practical exercises: they will allow the student to apply the concepts, techniques, and principles explained in the classroom.
- Final exam: the student will have to do a final exam where he/she will show that he/she has acquired the basic concepts explained in the classroom.
- Project: the student will have to propose a project and an architectural solution for it. The result of this work will have to be reflected in a document. In addition, before submitting this document, the student will have to do an oral presentation in the classroom where the preliminary results of his/her work will be summarized.

The final grade encompasses the participation of the student in the classes. In this sense, the classroom participation grade stands for the ratio of attendance multiplied by 10. Additionally, **students will have to attend some prefixed classes associated with evaluation activities, which will be reported at least 15 days prior to the day of the evaluation activity.**

The final grade (FG) will be calculated from the grade of the practical assignment (PAG), the exam grade (EG), the classroom participation grade (CPG), and the project grade (PG) by means of the following formula:

$$FG = 0.25 \cdot PAG + 0.25 \cdot EG + 0.45 \cdot PG + 0.05 \cdot CPG \text{ if } EG \geq 4 \text{ and } PG \geq 5$$

$$FG = 0 \text{ otherwise}$$

Where all the grades take values between 0 and 10.

1.2. Global evaluation

If the student fails to pass the final exam of the distributed evaluation, he/she will have a second chance in the global evaluation by doing another exam, which will determine the exam grade (EG) of the regular period.

In the global evaluation, failed practical assignments and the project will not be able to be passed because the solutions of the practical assignments will be solved and discussed in the classrooms during the classes and the deadline of the project will be within the period scheduled for the global evaluation in this master.



2. Extraordinary Period

When failed, in the extraordinary period the final grade will be obtained from the grade of a project (75%) and an exam (25%).

8. Teaching resources

8.1. Teaching resources for the subject

Name	Type	Notes
Moodle site	Web resource	https://moodle.upm.es/titulaciones/oficiales/course/view.php?id=1474
Bass, L. et al. (2013) Software Architecture in Practice. Addison-Wesley, Boston, MA, third edition	Bibliography	
Buschmann, F. et al. (1996) Pattern-Oriented Software Architecture: A System of Patterns, volume 1 de Software Design Patterns. John Wiley & Sons.	Bibliography	
Taylor, R. N. et al. (2009) Software Architecture: Foundations, Theory and Practice. John Wiley & Sons.	Bibliography	
Bachmann, F. et al. (2007) Modifiability Tactics. Inf. Téc. CMU/SEI-2007-TR-002, Software Engineering Institute - Carnegie Mellon University, Pittsburg, PA, USA.	Bibliography	
Gorton I. (2006) Essential Software Architecture. Springer-Verlag.	Bibliography	

8.1.3 Software Design



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LEARNING GUIDE

SUBJECT

103000483 - Software Design

DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

ACADEMIC YEAR & SEMESTER

2025/26 - Semester 2



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1. Description

1.1. Subject details

Name of the subject	103000483 - Software Design
No of credits	4 ECTS
Type	Compulsory
Academic year of the programme	First year
Semester of tuition	Semester 2
Tuition period	February-June
Tuition languages	English
Degree programme	10AM - Master Universitario en Ingeniería del Software
Centre	10 - E.T.S. De Ingenieros Informáticos
Academic year	2025-26

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Jaime Ramirez Rodriguez (Subject coordinator)	5112	jaime.ramirez@upm.es	Sin horario. The tutoring table can be found at: https://upm365-my.sharepoint.com/:x:/g/personal/m_jimenez_upm_es/EUOWGvHaU4JLmXdlPlxt2eQBQZ_wNYIFNXFGLzdiSm0Nqw?e=7Vfgai



Angelica De Antonio Jimenez	5108	angelica.deantonio@upm.es	M - 12:00 - 14:00 Tu - 17:00 - 19:30 W - 10:30 - 12:00 The tutoring table can be found at: https://upm365-my.sharepoint.com/:x:/g/personal/m_jimenez_upm_es/EUOWGvHaU4JLmXdlplxt2eQBQZ_wNYIFNXFGLzdiSm0Nqw?e=7Vfgai
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* The tutoring schedule is indicative and subject to possible changes. Please check tutoring times with the faculty member in charge.

3. Prior knowledge recommended to take the subject

3.1. Recommended (passed) subjects

The subject - recommended (passed), are not defined.

3.2. Other recommended learning outcomes

- Object Oriented Programming



4. Skills and learning outcomes *

4.1. Skills to be learned

CE12 - Concebir y realizar el diseño de los sistemas software asegurando atributos relevantes de calidad.

CG1 - Que los estudiantes sepan aplicar los conocimientos adquiridos y su capacidad de resolución de problemas en entornos nuevos o poco conocidos dentro de contextos más amplios (o multidisciplinares) relacionados con su área de estudio (RD)

CG10 - Capacidad de pensamiento creativo con el objetivo de desarrollar enfoques y métodos nuevos y originales

CG11 - Integración del conocimiento a partir de disciplinas diferentes, así como el manejo de la complejidad

CG14 - Conocimiento y comprensión de la informática necesaria para la creación de modelos de información, y de los sistemas y procesos complejos

CG18 - Capacidad de trabajar y comunicarse también en contextos internacionales

CG3 - Que los estudiantes sepan comunicar sus conclusiones y los conocimientos y razones últimas que las sustentan a públicos especializados y no especializados de un modo claro y sin ambigüedades (RD)

4.2. Learning outcomes

RA16 - The student will be able to evaluate any software system design.

RA14 - The student will be able to design a software system according to requirements, restrictions, quality standards, and developer criteria

RA15 - The student will be able to document each new design.

RA23 - Time organization capability SC13, SC14 K

RA22 - Observing capability SC13, SC14, CG10 C

RA21 - Listening capability SC13, SC14, CG10 A

RA27 - Negotiation skill SC13, SC14, CG18 C

RA25 - Communication skills in public SC13, SC14, CG3, CG18 S



RA24 - Conflict solving capability SC13, SC14, CG18 C

RA26 - Group work skill SC13, SC14, CG17 A

* The Learning Guides should reflect the Skills and Learning Outcomes in the same way as indicated in the Degree Verification Memory. For this reason, they have not been translated into English and appear in Spanish.

5. Brief description of the subject and syllabus

5.1. Brief description of the subject

This subject addresses the usage of object-oriented principles to model and design complex systems. It involves analyzing the problem domain, representing it using objects and their interactions, and then designing a modular solution. Also, this subject covers Object-Oriented Modeling Principles such as abstraction, encapsulation, decomposition, and generalization, and different types of inheritance and dependencies. Design Guidelines for modularity, separation of concerns, information hiding, and conceptual integrity are taught to create a flexible, reusable, maintainable design.

A significant part of the course is dedicated to Design Patterns, reusable solutions to common problems in software design, and Unified Modeling Language (UML), a standardized notation for creating diagrams that represent different aspects of a software system.



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5.2. Syllabus

1. Introduction to the development process
2. Requirements as entry point to the design
3. Domain modelling
4. High-level Design
5. Low-level Design
6. Design Principles and Patterns



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6. Schedule

6.1. Subject schedule*

Week	Type 1 activities	Type 2 activities	Distant / On-line	Assessment activities
1	Introduction to the development process Duration: 02:00 Lecture			
2	Domain modelling Duration: 02:00 Lecture			
3	High-level design Duration: 02:00 Lecture			
4	Workshop of high-level design Duration: 02:00 Problem-solving class			Practical assignment 1 Group work Progressive assessment and Global Examination Not Presential Duration: 08:00
5	Low-level design Duration: 02:00 Lecture			
6	Workshop of high-level design Duration: 01:00 Problem-solving class Low-level design Duration: 01:00 Lecture			Practical assignment 2 Group work Progressive assessment and Global Examination Not Presential Duration: 08:00
7	Low-level design Duration: 02:00 Lecture			
8	Design Principles and Patterns Duration: 02:00 Lecture			
9	Workshop of low-level design Duration: 02:00 Problem-solving class			Practical assignment 3 Group work Progressive assessment and Global Examination Not Presential Duration: 08:00
10	Design Principles and Patterns Duration: 02:00 Lecture			
11	Design Principles and Patterns Duration: 02:00 Lecture			



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12	Design Principles and Patterns Duration: 02:00 Lecture			Practical assignment 4 Group work Progressive assessment and Global Examination Not Presential Duration: 08:00
13	Design Principles and Patterns Duration: 02:00 Lecture			
14	Design Principles and Patterns Duration: 02:00 Lecture			
15	Student presentations of the assignment Duration: 03:00 Additional activities			Student presentations of the assignment Group presentation in the lab Progressive assessment and Global Examination Presential Duration: 03:00
16	Exam Duration: 02:00 Additional activities			Exam Written test Progressive assessment and Global Examination Presential Duration: 02:00 Practical assignment 5 Group work Progressive assessment and Global Examination Not Presential Duration: 16:00
17				

Depending on the programme study plan, total values will be calculated according to the ECTS credit unit as 26/27 hours of student face-to-face contact and independent study time.



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7. Activities and assessment criteria

7.1. Assessment activities

7.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
4	Practical assignment 1	Group work	No Presential	08:00	10%	4 / 10	CE12 CG10 CG11 CG14 CG18 CG1
6	Practical assignment 2	Group work	No Presential	08:00	10%	4 / 10	CE12 CG10 CG11 CG14 CG18 CG1
9	Practical assignment 3	Group work	No Presential	08:00	10%	4 / 10	CE12 CG10 CG11 CG14 CG18 CG1
12	Practical assignment 4	Group work	No Presential	08:00	10%	4 / 10	CE12 CG10 CG11 CG14 CG18 CG1
15	Student presentations of the assignment	Group presentation in the lab	Face-to-face	03:00	5%	4 / 10	CG3
16	Exam	Written test	Face-to-face	02:00	20%	4 / 10	CE12 CG11
16	Practical assignment 5	Group work	No Presential	16:00	35%	4 / 10	CE12 CG10 CG11 CG14 CG18 CG1

7.1.2. Global examination



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Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
4	Practical assignment 1	Group work	No Presential	08:00	10%	4 / 10	CE12 CG10 CG11 CG14 CG18 CG1
6	Practical assignment 2	Group work	No Presential	08:00	10%	4 / 10	CE12 CG10 CG11 CG14 CG18 CG1
9	Practical assignment 3	Group work	No Presential	08:00	10%	4 / 10	CE12 CG10 CG11 CG14 CG18 CG1
12	Practical assignment 4	Group work	No Presential	08:00	10%	4 / 10	CE12 CG10 CG11 CG14 CG18 CG1
15	Student presentations of the assignment	Group presentation in the lab	Face-to-face	03:00	5%	4 / 10	CG3
16	Exam	Written test	Face-to-face	02:00	20%	4 / 10	CE12 CG11
16	Practical assignment 5	Group work	No Presential	16:00	35%	4 / 10	CE12 CG10 CG11 CG14 CG18 CG1

7.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
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Exam	Written test	Face-to-face	02:00	20%	4 / 10	CE12 CG11
Practical assignment	Individual work	Face-to-face	10:00	80%	4 / 10	CE12 CG10 CG11 CG14 CG18 CG1 CG3

7.2. Assessment criteria

1. Regular Period

1.1. Distributed evaluation

Throughout the semester, in order to pass the course, the student will have to do the following assessment activities:

- Practical assignments: they will allow the student to apply the concepts, techniques, and principles explained in the classroom.
- Final exam: the student will have to do an exam where he/she will have to show that he/she has acquired the concepts explained in the classroom.

The final grade (FG) of the subject will be calculated from the grades of the practical assignments (PA1G, PA2G, PA3G, PA4G and PA5G) and the exam grade (EG) by means of the following formula:



$FG = 0.1*(PA1G + PA3G + PA4G) + 0.15*PA2G + 0.30*PA5G + 0.2*EG$, if $EG \geq 4$ and $Mean(PAXG) \geq 4$

$FG = 0$, otherwise

Where all the grades take values between 0 and 10.

1.2. Global evaluation

Due to the proximity of final assignment deadline, it will not be able to be recovered in the global evaluation. Additionally, as all the assignments are related to the same project and the solutions of the previous assignments will be explained in the classroom, these assignments will not be able to be recovered either.

The only assessment activity that will be able to be recovered will be the final exam.

To calculate the final grade, the same formula of the distributed evaluation will be employed.

2. Extraordinary Period

When failed, in this extraordinary period the final grade will be obtained from the grade of a practical assignment (80%) and an exam (20%).



8. Teaching resources

8.1. Teaching resources for the subject

Name	Type	Notes
Moodle	Bibliography	It contains or addresses the fundamental literature

9. Other information

9.1. Other information about the subject

In this course, the following innovative teaching methodology is applied:

- **Project-Based Learning:** it is implemented by engaging students teams in the development of a complete project. Professors propose a problem statement for the project with several deliverables. The project is then developed in several phases, each with a formal deliverable that represents a key part of the solution. For every deliverable, the professor discusses a possible solution with the students in the classroom and provides feedback for the students' solutions. At the end of the course, each team proposes a possible extension of the project in an oral presentation and discusses possible improvements with the professors, demonstrating not only their technical work but also their ability to communicate and reflect on the process.

8.2 Project Management and Organizational Processes Module

8.2.1 Models and Methods for Process Improvement and Assessment



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SUBJECT

103000486 - Models And Methods For Process Improvement And Assessments

DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

ACADEMIC YEAR & SEMESTER

2025/26 - Semester 1

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1. Description

1.1. Subject details

Name of the subject	103000486 - Models And Methods For Process Improvement And Assessments
No of credits	4 ECTS
Type	Compulsory
Academic year of the programme	First year
Semester of tuition	Semester 1
Tuition period	September-January
Tuition languages	English
Degree programme	10AM - Master Universitario en Ingeniería del Software
Centre	10 - E.T.S. De Ingenieros Informáticos
Academic year	2025-26

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Jose Antonio Calvo-Manzano Villalon (Subject coordinator)	5107	joseantonio.calvomanzano@upm.es	M - 10:30 - 13:30 W - 10:30 - 13:30
Tomas San Feliu Gilabert	5107	tomas.sanfeliu@upm.es	M - 10:00 - 13:00 W - 10:00 - 13:00

* The tutoring schedule is indicative and subject to possible changes. Please check tutoring times with the faculty member in charge.

3. Prior knowledge recommended to take the subject

3.1. Recommended (passed) subjects

The subject - recommended (passed), are not defined.

3.2. Other recommended learning outcomes

- Knowledge about the software life cycle processes (activities and tasks)

4. Skills and learning outcomes *

4.1. Skills to be learned

CE10 - Evaluar de forma objetiva los procesos y productos frente a los estándares y normas aplicables.

CE9 - Definir, evaluar y mejorar los procesos software de una organización.

CG1 - Que los estudiantes sepan aplicar los conocimientos adquiridos y su capacidad de resolución de problemas en entornos nuevos o poco conocidos dentro de contextos más amplios (o multidisciplinares) relacionados con su área de estudio (RD)

CG17 - Habilidades de gestión y capacidad de liderar un equipo que puede estar integrado por disciplinas y niveles distintos

CG18 - Capacidad de trabajar y comunicarse también en contextos internacionales



CG3 - Que los estudiantes sepan comunicar sus conclusiones y los conocimientos y razones últimas que las sustentan a públicos especializados y no especializados de un modo claro y sin ambigüedades (RD)

4.2. Learning outcomes

RA36 - Posee dotes para liderar el cambio dentro de la organización

RA37 - Está capacitado para introducir mejoras en la organización

RA35 - Es capaz de definir, evaluar y mejorar los procesos software de una organización

* The Learning Guides should reflect the Skills and Learning Outcomes in the same way as indicated in the Degree Verification Memory. For this reason, they have not been translated into English and appear in Spanish.

5. Brief description of the subject and syllabus

5.1. Brief description of the subject

New technologies are changing our way of life: airplanes, trains, communications, e-commerce, etc, and all of them need software to run. However, software is developed with poor quality; overruns in resources, effort and budget; and delays in delivery. It means that organizations must improve their way of producing software. In this context, it appears software process improvement. It consists of applying consistently the practices that provide good results, and changing those that cause problems.

So, enterprises should know their capacity/maturity level in order to develop software. The reference models are CMMI (Capability Maturity Model Integration with the views of Development, Services and Supplier Management), ISO 15504, and ITIL (Information Technology Infrastructure Library) among others. In order to be involved in a process improvement initiative, organizations should follow a process improvement lifecycle.

In this subject, and independently of the reference model used, a generic process improvement lifecycle oriented to large enterprises as well as small and medium-sized enterprises will be explained. In the main phase (the assessment phase), a method to make an assessment will be described. Students will have to make a plan in order to know the estimated hours and costs, resources and schedule involved in a process improvement initiative.

In the same way, a process improvement initiative in a small enterprise will be presented to students and they will have to analyse if the initiative is going to get benefits.

Later, the generic information related to the most known reference model (i.e., CMMI) will be explained

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(maturity/capability levels, and institutionalization).

Finally, students will have to assess their estimating process and make a brief analysis and presentation.

5.2. Syllabus

1. Introduction

- 1.1. Maturity Profile
- 1.2. State of the practice
- 1.3. Process Improvement (PI) concepts & Justifying PI

2. PI life cycles

- 2.1. IDEAL, ISO 15504, Action Focus Improvement Model (AFIM)
- 2.2. AFIM: Commitment
- 2.3. AFIM: Assessment
- 2.4. AFIM: Infrastructure&Action Plans, and Implementation
- 2.5. A PI initiative in a small company

3. Reference Process Models

- 3.1. CMMI Model
- 3.2. The Estimating Process



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6. Schedule

6.1. Subject schedule*

Week	Type 1 activities	Type 2 activities	Distant / On-line	Assessment activities
1	Chapter 1: Maturity Profile Report Duration: 00:30 Lecture Chapter 1: State of the practice. Process Improvement (PI) concepts. Duration: 01:30 Lecture			Discussion/Participating in class (NON-RECOVERABLE) Other assessment Progressive assessment Presential Duration: 02:00
2	Chapter 1: Justifying PI Duration: 00:30 Lecture Chapter 2: Process Improvement life cycles Duration: 00:30 Lecture Chapter 2: Process Improvement life cycles: AFIM: Commitment Duration: 00:30 Lecture Exercise related to ROI in Commitment Duration: 00:30 Problem-solving class			Discussion/Participating in class (NON-RECOVERABLE) Other assessment Progressive assessment Presential Duration: 02:00
3	Chapter 2: Process Improvement life cycles: AFIM: Commitment Duration: 01:30 Lecture Exercise related to ROI in Commitment Duration: 00:30 Problem-solving class			Discussion/Participating in class (NON-RECOVERABLE) Other assessment Progressive assessment Presential Duration: 02:00
4	Exercise related to ROI in Commitment Duration: 02:00 Problem-solving class			Discussion/Participating in class (NON-RECOVERABLE) Other assessment Progressive assessment Presential Duration: 02:00 Exercise related to ROI in Commitment Other assessment Progressive assessment Presential Duration: 00:10 Exercise related to ROI in Commitment: Best Presentation Award Other assessment Progressive assessment



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				Presential Duration: 00:05
5	Chapter 2: Process Improvement life cycles: AFIM: Assessment Duration: 01:30 Lecture Exercise related to ROI in Assessment Duration: 00:30 Problem-solving class			Discussion/Participating in class (NON-RECOVERABLE) Other assessment Progressive assessment Presential Duration: 02:00
6	Chapter 2: Process Improvement life cycles: AFIM: Assessment Duration: 01:30 Lecture Exercise related to ROI in Assessment Duration: 00:30 Problem-solving class			Discussion/Participating in class (NON-RECOVERABLE) Other assessment Progressive assessment Presential Duration: 02:00
7	Chapter 2: Process Improvement life cycles: AFIM: Assessment Duration: 01:30 Lecture Exercise related to ROI in Assessment Duration: 00:30 Problem-solving class			Discussion/Participating in class (NON-RECOVERABLE) Other assessment Progressive assessment Presential Duration: 02:00
8	Exercise related to ROI in Assessment Duration: 02:00 Problem-solving class			Discussion/Participating in class (NON-RECOVERABLE) Other assessment Progressive assessment Presential Duration: 02:00 Exercise related to ROI in Assessment Group work Progressive assessment Presential Duration: 00:15 Exercise related to ROI in Assessment: Best Presentation Award Other assessment Progressive assessment Presential Duration: 00:05
9	Chapter 2: Process Improvement life cycles: AFIM: Action Plans and Implementation Duration: 01:00 Lecture Exercise related to ROI in a Small Enterprise (statement) Duration: 01:00 Problem-solving class			Discussion/Participating in class (NON-RECOVERABLE) Other assessment Progressive assessment Presential Duration: 02:00



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10	Exercise related to ROI in a Small Enterprise Duration: 02:00 Problem-solving class			Discussion/Participating in class (NON-RECOVERABLE) Other assessment Progressive assessment Presential Duration: 02:00 Exercise related to ROI in a Small Enterprise Group work Progressive assessment Presential Duration: 00:10 Exercise related to ROI in a Small Enterprise: Best Presentation Award Other assessment Progressive assessment Presential Duration: 00:05
11	Chapter 3: CMMI Duration: 02:00 Lecture			Discussion/Participating in class (NON-RECOVERABLE) Other assessment Progressive assessment Presential Duration: 02:00
12	Chapter 3: CMMI Duration: 01:00 Lecture Chapter 3: CMMI: Estimating process Duration: 01:00 Lecture			Discussion/Participating in class (NON-RECOVERABLE) Other assessment Progressive assessment Presential Duration: 02:00
13	Exercise related to Assessment: the Estimating process Duration: 02:00 Problem-solving class			Discussion/Participating in class (NON-RECOVERABLE) Other assessment Progressive assessment Presential Duration: 02:00 Exercise related to Assessment: the Estimating process Group work Progressive assessment Presential Duration: 00:10 Exercise related to Assessment: in the Estimating process: Best Presentation Award Group work Progressive assessment Presential Duration: 00:05
14	Progressive Evaluation: Review Duration: 02:00 Lecture			Discussion/Participating in class (NON-RECOVERABLE) Other assessment Progressive assessment Presential Duration: 02:00



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15	Progressive Evaluation Duration: 02:00 Problem-solving class			Discussion/Participating in class (NON-RECOVERABLE) Other assessment Progressive assessment Presential Duration: 02:00 Progressive Evaluation Written test Progressive assessment Presential Duration: 02:00
16				Global Evaluation Written test Global examination Presential Duration: 02:00
17				

Depending on the programme study plan, total values will be calculated according to the ECTS credit unit as 26/27 hours of student face-to-face contact and independent study time.



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7. Activities and assessment criteria

7.1. Assessment activities

7.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
1	Discussion/Participating in class (NON- RECOVERABLE)	Other assessment	Face-to-face	02:00	1%	0 / 10	CG18 CG1
2	Discussion/Participating in class (NON-RECOVERABLE)	Other assessment	Face-to-face	02:00	1%	0 / 10	CG18 CG1
3	Discussion/Participating in class (NON-RECOVERABLE)	Other assessment	Face-to-face	02:00	1%	0 / 10	CG18 CG1
4	Discussion/Participating in class (NON-RECOVERABLE)	Other assessment	Face-to-face	02:00	1%	0 / 10	CG18 CG1
4	Exercise related to ROI in Commitment	Other assessment	Face-to-face	00:10	10%	5 / 10	CE9 CE10 CG17 CG18 CG1 CG3
4	Exercise related to ROI in Commitment: Best Presentation Award	Other assessment	Face-to-face	00:05	0%	0 / 10	CG18 CG3
5	Discussion/Participating in class (NON-RECOVERABLE)	Other assessment	Face-to-face	02:00	1%	0 / 10	CG18 CG1
6	Discussion/Participating in class (NON-RECOVERABLE)	Other assessment	Face-to-face	02:00	1%	0 / 10	CG18 CG1
7	Discussion/Participating in class (NON-RECOVERABLE)	Other assessment	Face-to-face	02:00	1%	5 / 10	CG18 CG1
8	Discussion/Participating in class (NON-RECOVERABLE)	Other assessment	Face-to-face	02:00	1%	0 / 10	CG18 CG1
8	Exercise related to ROI in Assessment	Group work	Face-to-face	00:15	20%	5 / 10	CE9 CE10 CG17 CG18 CG1 CG3
8	Exercise related to ROI in Assessment: Best Presentation Award	Other assessment	Face-to-face	00:05	%	0 / 10	CG18 CG3



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9	Discussion/Participating in class (NON-RECOVERABLE)	Other assessment	Face-to-face	02:00	1%	0 / 10	CG18 CG1
10	Discussion/Participating in class (NON-RECOVERABLE)	Other assessment	Face-to-face	02:00	1%	0 / 10	CG18 CG1
10	Exercise related to ROI in a Small Enterprise	Group work	Face-to-face	00:10	15%	5 / 10	CE9 CE10 CG17 CG18 CG1 CG3
10	Exercise related to ROI in a Small Enterprise: Best Presentation Award	Other assessment	Face-to-face	00:05	%	0 / 10	CG18 CG3
11	Discussion/Participating in class (NON-RECOVERABLE)	Other assessment	Face-to-face	02:00	1%	0 / 10	CG18 CG1
12	Discussion/Participating in class (NON-RECOVERABLE)	Other assessment	Face-to-face	02:00	1%	0 / 10	CG18 CG1
13	Discussion/Participating in class (NON-RECOVERABLE)	Other assessment	Face-to-face	02:00	1%	0 / 10	CG18 CG1
13	Exercise related to Assessment: the Estimating process	Group work	Face-to-face	00:10	15%	5 / 10	CE9 CE10 CG17 CG18 CG1 CG3
13	Exercise related to Assessment: in the Estimating process: Best Presentation Award	Group work	Face-to-face	00:05	%	0 / 10	CG18 CG3
14	Discussion/Participating in class (NON-RECOVERABLE)	Other assessment	Face-to-face	02:00	1%	0 / 10	CG18 CG1
15	Discussion/Participating in class (NON-RECOVERABLE)	Other assessment	Face-to-face	02:00	1%	0 / 10	CG18 CG1
15	Progressive Evaluation	Written test	Face-to-face	02:00	25%	5 / 10	CE9 CE10 CG18 CG1 CG3

7.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
16	Global Evaluation	Written test	Face-to-face	02:00	85%	5 / 10	CE9 CE10 CG17 CG18 CG1 CG3



7.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Final Test	Written test	Face-to-face	03:00	100%	5 / 10	CE9 CE10 CG17 CG18 CG1 CG3

7.2. Assessment criteria

The assessment activities are the following:

1. Attendance and Active participation of students during the classes (15%). This is a NON-RECOVERABLE activity because the specific class and its discussion is not going to be repeated. This is an INDIVIDUAL activity.
2. Group Exercises related to Return on Investment (ROI) in Commitment (10%), Assessment (20%).. These are TEAM activities.
3. Group Exercise related to ROI in a Small enterprise (15%). This is a TEAM activity
4. Group Exercise related to the Assessment of the Estimating Process (15%). This is a TEAM activity.
5. Individual Progressive evaluation exam (25%) related to the main concepts of the subject. This is an INDIVIDUAL activity.

It should be noted that to motivate students in making presentations, there are some Best Presentation Award activities. The way to choose the best presentation is by voting with the rest of the students (but you cannot vote for the team to which you belong to). The team that wins the best presentation award will have 0.1 extra points in the final grade for the subject.

The previous assessment activities can be recovered (except activity 1), if failed, in the Global Evaluation Test (16 week). In order to recover the activities, the student must have obtained a grade greater than zero in the corresponding activity.

Students should have a rating greater or equal than 5.0 (over 10) to pass each activity (except activity 1). If not, the activities can be recovered in the Global Evaluation Test (when grading is greater than zero)..



In the global evaluation (week 16), the grade of this exam computes the 85% of the final grade. The remaining 15% corresponds to the rating obtained in the previous activity 1.

8. Teaching resources

8.1. Teaching resources for the subject

Name	Type	Notes
Subject Moodle Site	Web resource	Students will be able to get the slides and other resources from the Moodle platform.
IDEAL	Bibliography	McFeeley, B.; IDEAL: A User's Guide for Software Process Improvement; Handbook CMU/SEI-96-HB-001; February 1996
SCAMPI	Bibliography	SCAMPI Upgrade Team; Standard CMMI® Appraisal Method for Process Improvement (SCAMPI) A, Version 1.3: Method Definition Document; Handbook CMU/SEI 2011-HB-?001; March 2011
CMMI Model V2.0	Bibliography	CMMI Institute, CMMI V2.1 Model, December 2018



9. Other information

9.1. Other information about the subject

This course implements various innovative teaching methodologies to motivate and reinforce student learning.

1) The Virtual Collaboration methodology is implemented in all team exercises. Students, grouped into teams, can solve problems in person or collaborate through ICT (using applications such as Teams or Zoom for communication and OneDrive for file sharing). This allows students to connect remotely and work as a team. Furthermore, the instructor can join one of these meetings if necessary to address any questions or concerns.

2) The Learning-by-Doing methodology is applied in the course by defining the problem to be solved, which is developed in two or three exercises. What students do in the first exercise serves as a guide for what they will do in the second (and, if applicable, a third). To this end, the instructor initially explains the theoretical aspects of the different activities along with a practical example, and then the students, in teams of three to five members, carry out these activities. The teacher evaluates the first exercise and provides feedback to the students so that subsequent exercises can take it into account.

8.2.2 Software Project Management



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GUÍA DE APRENDIZAJE

ASIGNATURA

103000485 - Software Project Management

PLAN DE ESTUDIOS

10AM - Master Universitario En Ingeniería Del Software

CURSO ACADÉMICO Y SEMESTRE

2025/26 - Primer semestre



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1. Datos descriptivos

1.1. Datos de la asignatura

Nombre de la asignatura	103000485 - Software Project Management
No de créditos	4 ECTS
Carácter	Obligatoria
Curso	Primer curso
Semestre	Primer semestre
Período de impartición	Septiembre-Enero
Idioma de impartición	Inglés/Castellano
Titulación	10AM - Master Universitario en Ingeniería del Software
Centro responsable de la titulación	10 - E.T.S. De Ingenieros Informáticos
Curso académico	2025-26

2. Profesorado

2.1. Profesorado implicado en la docencia

Nombre	Despacho	Correo electrónico	Horario de tutorías *
Ana María Moreno Sanchez-Capuchino (Coordinador/a)	5102	anamaria.moreno@upm.es	L - 15:00 - 21:00
Tomas San Feliu Gilabert	D 5105	tomas.sanfeliu@upm.es	L - 10:00 - 12:00 X - 10:00 - 12:00

* Las horas de tutoría son orientativas y pueden sufrir modificaciones. Se deberá confirmar los horarios de tutorías con el profesorado.

3. Competencias y resultados de aprendizaje

3.1. Competencias

CE1 - Elaborar un plan de proyecto que permita coordinar y priorizar recursos y actividades para obtener los resultados esperados en los plazos, costes y calidad establecidos

CE2 - Llevar a cabo la monitorización de un proyecto software y tomar acciones correctivas si fuera necesario

CE3 - Elaborar una estimación de los parámetros del proyecto software.

CG1 - Que los estudiantes sepan aplicar los conocimientos adquiridos y su capacidad de resolución de problemas en entornos nuevos o poco conocidos dentro de contextos más amplios (o multidisciplinares) relacionados con su área de estudio (RD)

CG14 - Conocimiento y comprensión de la informática necesaria para la creación de modelos de información, y de los sistemas y procesos complejos

CG18 - Capacidad de trabajar y comunicarse también en contextos internacionales

CG2 - Que los estudiantes sean capaces de integrar conocimientos y enfrentarse a la complejidad de formular juicios a partir de una información que, siendo incompleta o limitada, incluya reflexiones sobre las responsabilidades sociales y éticas vinculadas a la aplicación de sus conocimientos y juicios (RD)

CG5 - Organización y planificación



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3.2. Resultados del aprendizaje

RA25 - Communication skills in public SC13, SC14, CG3, CG18 S

RA61 - Identify the elements of a risk management plan and its rationale

RA2 - Facing a real problem, chooses an appropriate Software Engineering solution, analyzing its viability, what can and cannot be achieved from the current state of development of the selected solution, and what is expected to advance in the future

RA58 - Development of a business case for a software project

RA59 - Development of a project plan using as input estimation data

RA26 - Group work skill SC13, SC14, CG17 A

RA60 - Re-plannification of a software project with monitoring information

4. Descripción de la asignatura y temario

4.1. Descripción de la asignatura

This subject covers the different activities to be performed by a software project manager to successfully drive a software project. For that aim, both workshops and theoretical lecturers will be provided.

4.2. Temario de la asignatura

1. Introduction to Software Project Management
 - 1.1. Psychological Model of Software Engineers
 - 1.2. Leadership versus Management
 - 1.3. The Basic Functions of Project Management
 - 1.4. Developing the Business Case
2. Developing and Motivating the Project Team
 - 2.1. What it Takes for a Team to be Effective
 - 2.2. The Basics of Personalities
 - 2.3. Motivating Software Engineers
3. Strategic Approaches to Project Planning
 - 3.1. The Balanced Scorecard (BSC)
 - 3.2. Using SWOT to Develop the BSC
 - 3.3. Tracking Progress
4. Estimating Project Size, Cost, Schedule
5. Project Risk Management
 - 5.1. What Risk is/is not
 - 5.2. Strategies for Mitigating Risk
 - 5.3. Risk Management Methods
6. Tracking the Progress of a Software Project
 - 6.1. Earned Value Management
 - 6.2. Time Value



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5. Cronograma

5.1. Cronograma de la asignatura *

Sem	Actividad tipo 1	Actividad tipo 2	Tele-enseñanza	Actividades de evaluación
1	Chapter 1. Introduction to Software Project Management Duración: 02:00 LM: Actividad del tipo Lección Magistral			
2	Software Project Management Model (Lego) Duración: 02:00 G: Gamificación			
3	Chapter 2. Managing and Motivating your Team Duración: 02:00 LM: Actividad del tipo Lección Magistral			Partial presentation PG: Técnica del tipo Presentación en Grupo Evaluación Progresiva Presencial Duración: 02:00
4	Chapter 2. Know your team Duración: 02:00 AC: Actividad del tipo Acciones Cooperativas			
5	Chapter 3. Strategic Approaches to Project Management Duración: 02:00 LM: Actividad del tipo Lección Magistral			
6	Chapter 4. Estimating and Sizing your Project Duración: 02:00 LM: Actividad del tipo Lección Magistral			Partial presentation PG: Técnica del tipo Presentación en Grupo Evaluación Progresiva Presencial Duración: 02:00
7	Building Blocks Workshop Duración: 02:00 G: Gamificación			
8	SPM Complementary Knowledge Duración: 02:00 AC: Actividad del tipo Acciones Cooperativas			
9	Chapter 5. Risk Management Duración: 02:00 LM: Actividad del tipo Lección Magistral			
10	Chapter 5. Risk Management Duración: 02:00 AC: Actividad del tipo Acciones Cooperativas			Partial presentation PG: Técnica del tipo Presentación en Grupo Evaluación Progresiva Presencial Duración: 02:00



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11	Chapter 6. Project Monitoring Duración: 02:00 AC: Actividad del tipo Acciones Cooperativas			
12	Chapter 6. Project Monitoring Duración: 02:00 AC: Actividad del tipo Acciones Cooperativas			Partial presentation PG: Técnica del tipo Presentación en Grupo Evaluación Progresiva Presencial Duración: 02:00
13	Soft Skills Workshop Duración: 02:00 AC: Actividad del tipo Acciones Cooperativas			
14	Software Project Management Metamodel Duración: 02:00 G: Gamificación			Active participation of students OT: Otras técnicas evaluativas Evaluación Progresiva No presencial Duración: 00:00
15	Final Presentation of Students Projects Duración: 02:00 OT: Otras actividades formativas / Evaluación			Final Report TG: Técnica del tipo Trabajo en Grupo Evaluación Progresiva No presencial Duración: 00:00 Final Presentation TG: Técnica del tipo Trabajo en Grupo Evaluación Progresiva Presencial Duración: 02:00 Active Participation of Students OT: Otras técnicas evaluativas Evaluación Global Presencial Duración: 02:00
16	Industrial Seminar Duración: 02:00 OT: Otras actividades formativas / Evaluación			
17				Final Report TG: Técnica del tipo Trabajo en Grupo Evaluación Global No presencial Duración: 00:00

Para el cálculo de los valores totales, se estima que por cada crédito ECTS el alumno dedicará dependiendo del plan de estudios, entre 26 y 27 horas de trabajo presencial y no presencial.



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6. Actividades y criterios de evaluación

6.1. Actividades de evaluación de la asignatura

6.1.1. Evaluación (progresiva)

Sem.	Descripción	Modalidad	Tipo	Duración	Peso en la nota	Nota mínima	Competencias evaluadas
3	Partial presentation	PG: Técnica del tipo Presentación en Grupo	Presencial	02:00	10%	0 / 10	
6	Partial presentation	PG: Técnica del tipo Presentación en Grupo	Presencial	02:00	10%	0 / 10	
10	Partial presentation	PG: Técnica del tipo Presentación en Grupo	Presencial	02:00	10%	0 / 10	
12	Partial presentation	PG: Técnica del tipo Presentación en Grupo	Presencial	02:00	10%	0 / 10	
14	Active participation of students	OT: Otras técnicas evaluativas	No Presencial	00:00	10%	0 / 10	
15	Final Report	TG: Técnica del tipo Trabajo en Grupo	No Presencial	00:00	40%	5 / 10	CE1 CE3 CG18 CE2 CG5 CG2 CG14 CG1
15	Final Presentation	TG: Técnica del tipo Trabajo en Grupo	Presencial	02:00	10%	5 / 10	CE2 CG5 CG18 CG2 CG14 CG1 CE1 CE3

6.1.2. Prueba evaluación global



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Sem	Descripción	Modalidad	Tipo	Duración	Peso en la nota	Nota mínima	Competencias evaluadas
15	Active Participation of Students	OT: Otras técnicas evaluativas	Presencial	02:00	15%	0 / 10	CE1 CE3 CE2 CG5 CG18 CG2 CG14 CG1
17	Final Report	TG: Técnica del tipo Trabajo en Grupo	No Presencial	00:00	85%	5 / 10	

6.1.3. Evaluación convocatoria extraordinaria

Descripción	Modalidad	Tipo	Duración	Peso en la nota	Nota mínima	Competencias evaluadas
Final Project Report	TI: Técnica del tipo Trabajo Individual	Presencial	00:00	85%	5 / 10	CE1 CE3 CE2 CG5 CG18 CG2 CG14 CG1
Active participation of students	OT: Otras técnicas evaluativas	Presencial	00:00	15%	0 / 10	

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6.2. Criterios de evaluación

During the progressive evaluation, the final grade of students will be calculated according to their performance in the reports to be done and their class participation.

- Active participation of students (10%)
- Content of the reports (40%)
- Presentation of the report (50% - 10% each presentation)

Students must get a minimum of 5 points (over 10) in the assessment of the content of the report in order to pass the matter.

Students must get a minimum of 5 points (over 10) as final grade in order to pass the matter.

During the global and extraordinary evaluation, the final grade of students will be calculated according to their performance in the report to be done and their class participation. If students have attended to the lecturers during the course, they will be evaluated accordingly in the "Active participation" activity. If not, their grade in the "Active participation" activity will be 0

- Active participation of students (15%)
- Content of the reports (85%)

Students must get a minimum of 5 points (over 10) in the assessment of the report in order to pass the matter.

7. Recursos didácticos

7.1. Recursos didácticos de la asignatura

Nombre	Tipo	Observaciones
Bibliography	Bibliografía	Managing Software Projects on the Edge of Chaos: from Antipatterns to Success,? a Kindle eBook, by Lawrence Peters, Software Consultants International Limited, Auburn, Washington, May, 2015.

8.3 Support Processes Module

8.3.1 Software Metrics



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LEARNING GUIDE

SUBJECT

103000488 - Software Metrics

DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

ACADEMIC YEAR & SEMESTER

2025/26 - Semester 1



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1. Description

1.1. Subject details

Name of the subject	103000488 - Software Metrics
No of credits	4 ECTS
Type	Compulsory
Academic year of the programme	First year
Semester of tuition	Semester 1
Tuition period	September-January
Tuition languages	English
Degree programme	10AM - Master Universitario en Ingeniería del Software
Centre	10 - E.T.S. De Ingenieros Informáticos
Academic year	2025-26

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Tomas San Feliu Gilabert (Subject coordinator)	D5106	tomas.sanfeliu@upm.es	M - 10:00 - 13:00 W - 10:00 - 13:00
Jose Antonio Calvo-Manzano Villalon	D5107	joseantonio.calvomanzano@upm.es	M - 10:30 - 13:30 W - 10:30 - 13:30

* The tutoring schedule is indicative and subject to possible changes. Please check tutoring times with the faculty member in charge.



3. Skills and learning outcomes *

3.1. Skills to be learned

CE10 - Evaluar de forma objetiva los procesos y productos frente a los estándares y normas aplicables.

CG1 - Que los estudiantes sepan aplicar los conocimientos adquiridos y su capacidad de resolución de problemas en entornos nuevos o poco conocidos dentro de contextos más amplios (o multidisciplinares) relacionados con su área de estudio (RD)

CG12 - Comprensión amplia de las técnicas y métodos aplicables en una especialización concreta, así como de sus límites

CG18 - Capacidad de trabajar y comunicarse también en contextos internacionales

CG2 - Que los estudiantes sean capaces de integrar conocimientos y enfrentarse a la complejidad de formular juicios a partir de una información que, siendo incompleta o limitada, incluya reflexiones sobre las responsabilidades sociales y éticas vinculadas a la aplicación de sus conocimientos y juicios (RD)

3.2. Learning outcomes

RA79 - The student will be able to analyze data for estimation, planning and quality control in software projects

RA78 - The student will be able to lead and implement measurement plans for the evaluation of processes and products

RA45 - Es capaz de analizar datos para la estimación, planificación y control de calidad en proyectos software

RA44 - Es capaz de liderar e implantar planes de medida para la evaluación de procesos y productos

RA11 - Understands the interrelation between product quality and process quality

RA16 - The student will be able to evaluate any software system design.

* The Learning Guides should reflect the Skills and Learning Outcomes in the same way as indicated in the Degree Verification Memory. For this reason, they have not been translated into English and appear in Spanish.



4. Brief description of the subject and syllabus

4.1. Brief description of the subject

The students will:

- Understand the theoretical aspects of software measurements.
- Demonstrate the knowledge of software metrics.
- Demonstrate the knowledge of using software metrics in software development, software maintenance, and software project management.
- Demonstrate the knowledge of developing and maintaining a measurement program.

4.2. Syllabus

1. Introduction to measurement theory
 - 1.1. Why measure?
 - 1.2. Measure elements
2. Measuring Product Attributes
 - 2.1. Internal Product Attributes
 - 2.2. External Product Attributes
3. Measuring Process
4. Designing Metrics Program
 - 4.1. Goal Question Metrics
5. Frameworks for Software Measurements
 - 5.1. ISO 15939
 - 5.2. Practical Software and System Measurement
 - 5.3. Continuous Iterative Development
6. Agile Metrics
7. Visualization and Decision Making with Software Measurements



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5. Schedule

5.1. Subject schedule*

Week	Type 1 activities	Type 2 activities	Distant / On-line	Assessment activities
1	Chapter 1.1 Why Measure Duration: 02:00 Lecture			
2	Chapter 1.2: Measuring Elements Duration: 02:00 Lecture			
3	Chapter 2.1 Measuring Internal Product Attributes Duration: 02:00 Lecture			Quiz 1 Online test Progressive assessment Not Presential Duration: 00:30
4	Chapter 2.2 Measuring External Product Attributes Duration: 02:00 Lecture			
5	Chapter 2.2 Measuring External Product Attributes Duration: 02:00 Lecture			
6	Chapter 2.2 Measuring External Product Attributes Duration: 02:00 Lecture			Quiz 2 Online test Progressive assessment Not Presential Duration: 00:30
7	Chapter 4. Designing Metrics Program Duration: 02:00 Lecture			
8	Chapter 4. Designing Metrics Program Duration: 02:00 Lecture			
9	Chapter 4. Designing Metrics Program Duration: 02:00 Lecture			Quiz 3 Online test Progressive assessment Not Presential Duration: 00:30
10	Chapter 4. Designing Metrics Program Duration: 02:00 Lecture			Measurement Goal Definition Group work Progressive assessment Not Presential Duration: 02:00
11	Chapter 4. Designing Metrics Program Duration: 02:00 Lecture			Quiz 4 Online test Progressive assessment Not Presential Duration: 00:30



12	Chapter 5. Frameworks for Software Measurements Duration: 02:00 Lecture			
13	Chapter 6. Agile Metrics Duration: 02:00 Lecture			Quiz5 Online test Progressive assessment Not Presential Duration: 00:30
14	Chapter 7 Visualization and Decision Making with Software Measurements Duration: 02:00 Lecture			
15	Evaluation Recovery Test Duration: 02:00 Additional activities			Final Report Group work Progressive assessment Not Presential Duration: 02:00 Evaluation Recovery Test Online test Progressive assessment Presential Duration: 02:00
16				Progressive Evaluation Online test Progressive assessment Not Presential Duration: 02:00 Global Evaluation Online test Global examination Not Presential Duration: 02:00
17				

Depending on the programme study plan, total values will be calculated according to the ECTS credit unit as 26/27 hours of student face-to-face contact and independent study time.



6. Activities and assessment criteria

6.1. Assessment activities

6.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
3	Quiz 1	Online test	No Presential	00:30	5%	0 / 10	CE10 CG2 CG18
6	Quiz 2	Online test	No Presential	00:30	5%	4 / 10	CE10
9	Quiz 3	Online test	No Presential	00:30	5%	4 / 10	CE10 CG2 CG18
10	Measurement Goal Definition	Group work	No Presential	02:00	20%	4 / 10	CE10 CG12
11	Quiz 4	Online test	No Presential	00:30	5%	4 / 10	CE10 CG2 CG18
13	Quiz5	Online test	No Presential	00:30	5%	0 / 10	CE10 CG2 CG18
15	Final Report	Group work	No Presential	02:00	25%	4 / 10	CG2 CG12 CG18 CG1
15	Evaluation Recovery Test	Online test	Face-to-face	02:00	%	5 / 10	CG12 CG18 CG1 CE10 CG2
16	Progressive Evaluation	Online test	No Presential	02:00	30%	5 / 10	CG2 CG12 CG18 CG1 CE10

6.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
------	-------------	----------	------	----------	--------	---------------	------------------



16	Global Evaluation	Online test	No Presential	02:00	100%	5 / 10	CE10 CG2 CG12 CG18 CG1
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6.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Extraordinary Evaluation	Written test	Face-to-face	00:30	100%	5 / 10	CE10 CG2 CG18

6.2. Assessment criteria

The final grade for the course is determined based on the following components:

Five questionnaires: 25%

Measurement Goal Definition: 20%

Final report: 25%

Progressive Evaluation questionnaire: 30%

To pass each component, students must achieve a minimum score of 5.0 out of 10. If a student does not meet this threshold for any component (but scores above zero), they may retake the respective component during the Evaluation Recovery Test in Week 15. The new scores from the Evaluation Recovery Test will replace the original scores and will be combined with the marks from other components (including group exercises) to calculate the grade for the ordinary evaluation period.

In Week 16, two exams will take place:



- **Progressive Evaluation Exam (30% of the final grade):** This exam is for students who have successfully completed all the aforementioned components. The score from this exam will complete the remaining 30% of the final grade, bringing the total to 100% of the course grade.
- **Global Evaluation Exam:** This exam is for students who have not passed one or more of the progressive evaluation components. The score from this exam will replace the failed components and will be combined with the marks from other components (including group exercises and class participation) to calculate the final grade for the ordinary evaluation period.

If a student does not pass the course during the ordinary evaluation period, they may take a final comprehensive test during the extraordinary evaluation period in July. The grade from this test will be used to calculate the final course grade.

7. Teaching resources

7.1. Teaching resources for the subject

Name	Type	Notes
Metrics and Models in Software Quality Engineering	Bibliography	Stephen Kan, Metrics and Models in Software Quality Engineering, Addison Wesley 2003
Measuring the Software Process	Bibliography	Anita Carleton, Measuring the Software Process, Addison Wesley
The big book of Six Sigma training games	Bibliography	Chris Chen and Hadley Roth, The big book of Six Sigma training games, McGraw-Hill, 2005

8. Other information

8.1. Other information about the subject

All student work is required to be their own. While we encourage research and reuse, all submissions must be your own, original creation.

Copying/ Plagiarism is NOT tolerated. This is standard policy.

This applies to ALL work, be it code related or written/ essay style submission.

Use of a GPT/ AI, you may use GPT or other AI tools for searching and/ or reference, with the following conditions:

1.- If you use a GPT (ChatGPT or other, similar tools) you must also do the following:

- Submit your prompts for GPT (as a separate file) as part of your work
- Provide a confirming statement that GPT was used as reference only, and your work is original.

2.-If ANY of your work is found to be copied (from online sources OR ChatGPT/ AI), you would be subject to serious penalties which could be one or more of the following:

- Zero on the assignment
- Zero on the final grade

Regarding innovative teaching methodologies:

In the Software Metrics course, students are required to create a project that addresses specific requirements by forming teams of at least three to eight individuals (practical approach). This is in reference to innovative teaching methodologies.

The project is selected by the groups from a collection of project statements that represent various companies with distinct challenges that they must address. To finalize this project, it is necessary to implement the procedures for generating the measurement program. The instructor initially provides a description of the project and its scope, as well as the objectives that must be met in each development step. The instructor provides a detailed explanation of



the various activities that are to be completed, ensuring that the teams are aware of the anticipated deliverables.

The endeavor must be planned by the teams, necessitating a strong commitment from all members. The teams are required to implement the theory in the project as it is explicated. The instructor is available to address any inquiries or concerns at any time.

This course employs a variety of innovative teaching methodologies to reinforce and motivate student learning.

1) The Virtual Collaboration methodology is implemented throughout the undertaking. Students can either complete the various activities in person or collaborate using applications such as Teams or Zoom to communicate and OneDrive to share files. They are divided into teams. This enables them to collaborate remotely. Additionally, the instructor has the option to attend any of these meetings in order to address any queries or concerns.

2) The Learning-by-Doing methodology is applied in the course through a project developed in ten consecutive steps. The project, developed in ten consecutive stages, serves as the vehicle through which the Learning-by-Doing methodology is implemented in the course. To accomplish this, the instructor initially provides practical examples and theoretical explanations of the various activities, which are then executed by the teams.

8.3.2 Verification and Validation



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SUBJECT

103000489 - Verification And Validation

DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

ACADEMIC YEAR & SEMESTER

2025/26 - Semester 1

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1. Description

1.1. Subject details

Name of the subject	103000489 - Verification And Validation
No of credits	6 ECTS
Type	Compulsory
Academic year of the programme	First year
Semester of tuition	Semester 1
Tuition period	September-January
Tuition languages	English
Degree programme	10AM - Master Universitario en Ingeniería del Software
Centre	10 - E.T.S. De Ingenieros Informáticos
Academic year	2025-26

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Sira Vegas Hernandez (Subject coordinator)	5105	sira.vegas@upm.es	M - 12:00 - 15:00 Th - 14:00 - 17:00
Natalia Juristo Juzgado	5104	natalia.juristo@upm.es	Sin horario.

* The tutoring schedule is indicative and subject to possible changes. Please check tutoring times with the faculty member in charge.



3. Prior knowledge recommended to take the subject

3.1. Recommended (passed) subjects

The subject - recommended (passed), are not defined.

3.2. Other recommended learning outcomes

- Programming languages C and JAVA

4. Skills and learning outcomes *

4.1. Skills to be learned

CE7 - Elaborar un plan de verificación y validación que permita coordinar y priorizar recursos y actividades para garantizar el nivel de calidad requerido.

CE8 - Aplicar las técnicas de verificación y validación más adecuadas para un proyecto de desarrollo software, enmarcadas en un plan de verificación y validación.

CG1 - Que los estudiantes sepan aplicar los conocimientos adquiridos y su capacidad de resolución de problemas en entornos nuevos o poco conocidos dentro de contextos más amplios (o multidisciplinares) relacionados con su área de estudio (RD)

CG12 - Comprensión amplia de las técnicas y métodos aplicables en una especialización concreta, así como de sus límites

CG18 - Capacidad de trabajar y comunicarse también en contextos internacionales



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CG19 - Aproximación sistemática a la gestión de riesgos

CG4 - Que los estudiantes posean las habilidades de aprendizaje que les permitan continuar estudiando de un modo que habrá de ser en gran medida autodirigido o autónomo (RD)

4.2. Learning outcomes

RA12 - Knows and applies product and process quality control techniques

RA8 - Knows and determines the most appropriate verification and validation techniques to be applied in a software development project with the aim of assuring the quality level required

RA39 - Conoce y determina las técnicas de verificación y validación más apropiadas para aplicar en un proyecto de desarrollo de software con el objetivo de garantizar el nivel de calidad requerido

* The Learning Guides should reflect the Skills and Learning Outcomes in the same way as indicated in the Degree Verification Memory. For this reason, they have not been translated into English and appear in Spanish.

5. Brief description of the subject and syllabus

5.1. Brief description of the subject

No hay descripción de la asignatura.

5.2. Syllabus

1. Introduction

1.1. Introduction to V&V

1.2. V&V and the software development process

1.3. V&V and the software development products

2. Generative AI for software testing

2.1. Introduction to generative AI

2.2. Generative AI for software testing

2.3. Reading techniques

3. Dynamic evaluation: Software testing

3.1. Introduction to software testing



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3.2. Testing levels

3.3. The testing process

3.4. Software verification and validation plan

3.5. Testing tools



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6. Schedule

6.1. Subject schedule*

Week	Type 1 activities	Type 2 activities	Distant / On-line	Assessment activities
1	Course introduction Duration: 01:00 Lecture Introduction to generative AI Duration: 01:00 Lecture Introduction to software testing Duration: 02:00 Lecture			
2	Generative AI for software testing Duration: 02:00 Lecture Testing Duration: 02:00 Lecture			
3	Prompting Duration: 02:00 Lecture Testing Duration: 02:00 Lecture			
4	Prompting Duration: 02:00 Problem-solving class Testing Duration: 02:00 Problem-solving class			
5	Prompting Duration: 02:00 Problem-solving class Testing Duration: 02:00 Lecture			
6	Generative AI for software testing: follow-up of assignment Duration: 02:00 Problem-solving class Testing Duration: 02:00 Lecture			

8.3 Support Processes Module

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7	Generative AI for software testing: follow-up of assignment Duration: 02:00 Problem-solving class Testing Duration: 02:00 Problem-solving class			
8	Generative AI for software testing: follow-up of assignment Duration: 02:00 Problem-solving class Testing Duration: 02:00 Lecture			
9	Testing Duration: 02:00 Lecture			
10	Testing Duration: 02:00 Problem-solving class			
11	Testing: follow-up of assignment Duration: 02:00 Cooperative activities			Assignment: testing a software system (part 1) Group work Progressive assessment Not Presential Duration: 10:00
12	Testing: follow-up of assignment Duration: 02:00 Cooperative activities			
13	Testing: follow-up of assignment Duration: 02:00 Cooperative activities			
14	Quiz Duration: 02:00 Additional activities			Quiz Written test Progressive assessment Presential Duration: 02:00 Assignment: testing a software system (part 2) Group work Progressive assessment Not Presential Duration: 10:00
15	Testing Duration: 02:00 Lecture			Assignment: generative AI for software testing Group work Progressive assessment Not Presential Duration: 10:00
	Generative AI for software testing: assignment presentation Duration: 02:00 Additional activities			Assignment presentation: generative AI for software testing Group work Progressive assessment Presential Duration: 02:00 Attendance Other assessment



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16				Progressive assessment Presential Duration: 00:00 Quiz (second trial) Written test Global examination Presential Duration: 02:00 Assignment resubmission: testing a software system (part 1) Group work Global examination Not Presential Duration: 10:00 Assignment resubmission: testing a software system (part 2) Group work Global examination Not Presential Duration: 10:00 Assignment resubmission: generative AI for software testing Group work Global examination Not Presential Duration: 02:00 Assignment presentation (second chance): generative AI for software testing Group presentation Global examination Presential Duration: 10:00
17				

Depending on the programme study plan, total values will be calculated according to the ECTS credit unit as 26/27 hours of student face-to-face contact and independent study time.



7. Activities and assessment criteria

7.1. Assessment activities

7.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
11	Assignment: testing a software system (part 1)	Group work	No Presential	10:00	25%	3 / 10	CE8 CE7 CG4 CG18 CG1 CG19
14	Quiz	Written test	Face-to-face	02:00	10%	2 / 10	CG12 CE8 CE7
14	Assignment: testing a software system (part 2)	Group work	No Presential	10:00	25%	3 / 10	CE8 CE7 CG4 CG18 CG1 CG19
15	Assignment: generative AI for software testing	Group work	No Presential	10:00	20%	3 / 10	CE8 CE7 CG4 CG1 CG19
16	Assignment presentation: generative AI for software testing	Group work	Face-to-face	02:00	10%	5 / 10	CG12 CG18
16	Attendance	Other assessment	Face-to-face	00:00	10%	8 / 10	CE7 CE8

7.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
16	Quiz (second trial)	Written test	Face-to-face	02:00	10%	3 / 10	CE8 CE7 CG12
16	Assignment resubmission: testing a software system (part 1)	Group work	No Presential	10:00	25%	5 / 10	CE8 CE7 CG4 CG1 CG19



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16	Assignment resubmission: testing a software system (part 2)	Group work	No Presential	10:00	25%	5 / 10	CE8 CE7 CG4 CG1 CG19
16	Assignment resubmission: generative AI for software testing	Group work	No Presential	02:00	20%	5 / 10	CE8 CE7 CG4 CG1 CG19
16	Assignment presentation (second chance): generative AI for software testing	Group presentation	Face-to-face	10:00	10%	5 / 10	CG12 CG18

7.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Quiz (third trial)	Written test	Face-to-face	02:00	10%	3 / 10	CE8 CE7 CG12
Assignment second resubmission: testing a software system (part 1)	Group work	Face-to-face	10:00	25%	5 / 10	CE8 CE7 CG4 CG1 CG19
Assignment second resubmission: testing a software system (part 2)	Group work	Face-to-face	10:00	25%	5 / 10	CE8 CE7 CG4 CG1 CG19
Assignment presentation (third chance): generative AI for software testing	Group presentation	Face-to-face	10:00	10%	5 / 10	CG4 CG18
Assignment second resubmission: generative AI for software testing	Group work	Face-to-face	02:00	20%	5 / 10	CE8 CE7 CG4 CG1 CG19



7.2. Assessment criteria

Progressive evaluation period:

The score of the course is calculated regarding the performance of the student in the different tasks that (s)he has been assigned. A minimum overall score of 5 is needed to pass the course:

- Quiz (10% of the score).
- Assignment performing testing on a software system (50% of the score). This assignment is divided into two parts, submitted separately. Each part counts 25% of the score:
 - Testing a software system using a white box technique.
 - Testing a software system using a black box technique.
- Assignment about generative AI for software testing (30% of the score). This assignment is divided into two parts:
 - Doing the task proposed in the assignment (20% of the score).
 - Its presentation (10% of the score).

It will also be taken into consideration for the score of the course attendance to the lectures (10% of the score). A minimum of 80% of attendance is required to pass this evaluation criterion. **This task is unrecoverable.** Students that have a justification for not being able to fulfill this criterion (e.g. conciliation issues, health problems, etc.) will be offered an alternative to pass this criterion.

Global evaluation:

When the overall score obtained by the student in the progressive evaluation period is smaller than 5, the student will have to re-submit:

- All quizzes/assignments that do not reach the minimum score required.
- From those assignments that do reach the minimum required, but have a score smaller than 5, the student will choose which ones (s)he wants to re-submit.
- In no case quizzes that have a score equal or greater than the minimum required. will be re-taken.
- In no case assignments that have a score equal or greater than 5 will be re-submitted.

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- The score for the attendance criterion will be taken from the score obtained during the progressive evaluation period. In case the student has not reached the minimum score to pass this criterion during the progressive evaluation period, the global evaluation will be scored out of 9 instead of 10.

Note that during global evaluation, the student can re-submit those quizzes/assignments that have been submitted during the progressive evaluation period. It is not possible to submit quizzes/assignments for which there is not a submission in the progressive evaluation period.

A minimum score of 5 is needed to pass the course.

Extraordinary evaluation:

When the overall score obtained by the student in the global evaluation period is smaller than 5, the student will have to re-submit (or submit in case (s)he has not done it before):

- All quizzes/assignments that do not reach the minimum score required.
- From those assignments that do reach the minimum required, but have a score smaller than 5, the student will choose which ones (s)he wants to re-submit.
- In no case assignments that have a score equal or greater than 5 will be re-submitted.
- In no case quizzes that have a score equal or greater than the minimum required. will be re-taken.
- The score for the attendance criterion will be taken from the score obtained during the progressive evaluation period. In case the student has not reached the minimum score to pass this criterion during the progressive evaluation period, the global evaluation will be scored out of 9 instead of 10.

A minimum score of 5 is needed to pass the course.



8. Teaching resources

8.1. Teaching resources for the subject

Name	Type	Notes
B. Beizer. "Software Testing Techniques" 2ª Edición. 1990	Bibliography	
G. J. Myers. "The Art of Software Testing" 2ª Edición. Wiley. 2004.	Bibliography	
P.C. Jorgensen. Software Testing. A Craftsman's Approach. CRC Press, 1995.	Bibliography	
C. Kaner, J. Falk, H.Q. Nguyen. Testing Computer Software. Wiley, 1999.	Bibliography	
W.E. Perry. Effective methods for software testing. Tercera edición. Wiley. 2006	Bibliography	
S.L. Pfleeger. Ingeniería de software: teoría y práctica. Segunda edición. Prentice Hall. 2002	Bibliography	
IEEE V&V standards	Bibliography	
Moodle site of the course	Web resource	

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9. Other information

9.1. Other information about the subject

The course implements the following innovative teaching methodologies (<https://innovacioneducativa.upm.es/guiaspdi>) in order to motivate and reinforce student learning:

- **Project-based learning:** The course assessment includes the completion of a project focused on performing the testing of a real system developed by the students.

8.3.3 Software Quality Management



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GUÍA DE APRENDIZAJE

ASIGNATURA

103000487 - Software Quality Management

PLAN DE ESTUDIOS

10AM - Master Universitario En Ingeniería Del Software

CURSO ACADÉMICO Y SEMESTRE

2025/26 - Segundo semestre



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1. Datos descriptivos

1.1. Datos de la asignatura

Nombre de la asignatura	103000487 - Software Quality Management
No de créditos	4 ECTS
Carácter	Obligatoria
Curso	Primer curso
Semestre	Segundo semestre
Período de impartición	Febrero-Junio
Idioma de impartición	Inglés/Castellano
Titulación	10AM - Master Universitario en Ingeniería del Software
Centro responsable de la titulación	10 - E.T.S. De Ingenieros Informáticos
Curso académico	2025-26

2. Profesorado

2.1. Profesorado implicado en la docencia

Nombre	Despacho	Correo electrónico	Horario de tutorías *
Angelica De Antonio Jimenez (Coordinador/a)	5108	angelica.deantonio@upm.es	L - 12:00 - 14:00 M - 17:00 - 19:30 X - 11:30 - 12:00 Previous appointment should be requested at ang elica.deantonio@up m.es Check tutoring hours at: https://doc

			s.google.com/spreadsheets/d/1O2EIQzNBt7pKt-rTGc6JnySNJ-VT5nCz_BPAPMik2KY/edit?usp=sharing
Jaime Ramirez Rodriguez	5112	jaime.ramirez@upm.es	Sin horario. Previous appointment is recommended. Check tutoring hours at: https://docs.google.com/spreadsheets/d/1O2EIQzNBt7pKt-rTGc6JnySNJ-VT5nCz_BPAPMik2KY/edit?usp=sharing

* Las horas de tutoría son orientativas y pueden sufrir modificaciones. Se deberá confirmar los horarios de tutorías con el profesorado.

3. Competencias y resultados de aprendizaje

3.1. Competencias

CE1 - Elaborar un plan de proyecto que permita coordinar y priorizar recursos y actividades para obtener los resultados esperados en los plazos, costes y calidad establecidos

CE11 - Identificar, controlar, informar y auditar la configuración de un sistema y sus cambios

CE6 - Diseñar las pruebas de los módulos y ayudar a diseñar las pruebas de integración e instalación. Realizar la integración del sistema, las pruebas de integración y la instalación.

CE7 - Elaborar un plan de verificación y validación que permita coordinar y priorizar recursos y actividades para garantizar el nivel de calidad requerido.

CG1 - Que los estudiantes sepan aplicar los conocimientos adquiridos y su capacidad de resolución de problemas



en entornos nuevos o poco conocidos dentro de contextos más amplios (o multidisciplinares) relacionados con su área de estudio (RD)

CG12 - Comprensión amplia de las técnicas y métodos aplicables en una especialización concreta, así como de sus límites

CG18 - Capacidad de trabajar y comunicarse también en contextos internacionales

CG19 - Aproximación sistemática a la gestión de riesgos

CG2 - Que los estudiantes sean capaces de integrar conocimientos y enfrentarse a la complejidad de formular juicios a partir de una información que, siendo incompleta o limitada, incluya reflexiones sobre las responsabilidades sociales y éticas vinculadas a la aplicación de sus conocimientos y juicios (RD)

CG3 - Que los estudiantes sepan comunicar sus conclusiones y los conocimientos y razones últimas que las sustentan a públicos especializados y no especializados de un modo claro y sin ambigüedades (RD)

3.2. Resultados del aprendizaje

RA40 - Es capaz de identificar y establecer las prácticas necesarias para gestionar la configuración de un sistema software

RA42 - Comprende la interrelación entre calidad del producto y calidad del proceso

RA43 - Conoce y aplica técnicas de control de calidad de productos y procesos

RA7 - Knows and applies quality models to identify and specify the quality attributes a software system must satisfy

RA10 - Understands the mission of a quality system and knows the applicable standards and norms

RA8 - Knows and determines the most appropriate verification and validation techniques to be applied in a software development project with the aim of assuring the quality level required

RA9 - Is able to identify and determine the practices needed to manage a software system configuration

RA11 - Understands the interrelation between product quality and process quality

RA12 - Knows and applies product and process quality control techniques

RA38 - Conoce y aplica modelos de calidad para la identificación y especificación de los atributos de calidad a satisfacer por un sistema software

RA41 - Comprende la misión de un sistema de calidad y conoce los estándares y normas aplicables

RA39 - Conoce y determina las técnicas de verificación y validación más apropiadas para aplicar en un proyecto de desarrollo de software con el objetivo de garantizar el nivel de calidad requerido

4. Descripción de la asignatura y temario

4.1. Descripción de la asignatura

The goal of the Software Quality Management subject is to provide the student with a broad overview about the different aspects involved in the development of software with a required level of quality. The following questions are addressed:

- What is the meaning of quality in the software domain?
- How can we define precisely the quality required from a software system?
- How can we measure the quality of a software system?
- How can we measure the quality of a software process?
- How can we control quality during the development of a software system?
- How can we control the configuration and evolution of a software system?
- How can we build quality into the software being developed?
- How can we manage software quality from an organizational point of view?
- How can we evaluate the cost and benefits of quality?
- How can we make factual-based decisions about the quality of a software system?

4.2. Temario de la asignatura

1. Introduction to Software Quality
 - 1.1. Software Quality Definition
 - 1.2. Software Quality Models
 - 1.3. Usage of a Quality Model
 - 1.4. Defects and Defect Density
2. Software Quality Control Activities
 - 2.1. Static Controls
 - 2.2. Dynamic Controls
3. Quality Metrics
 - 3.1. Product and Process Quality Metrics



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- 3.2. Comparison of Quality Control Activities
- 4. Quality Management and Quality Systems
 - 4.1. Introduction to Quality Management and related standards and norms
 - 4.2. The Quality System and the Quality Manual
 - 4.3. Quality Management Tools
 - 4.4. The Cost of Quality
- 5. Software Quality Assurance Activities
 - 5.1. Introduction to Quality Assurance
 - 5.2. Quality Construction
 - 5.3. Quality Assurance Planning
- 6. Software Configuration Management
 - 6.1. Basic Concepts of Software Configuration Management
 - 6.2. Configuration Identification
 - 6.3. Configuration Change Control
 - 6.4. Configuration Status Accounting
 - 6.5. Configuration Audits
 - 6.6. Configuration Management Plan



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5. Cronograma

5.1. Cronograma de la asignatura *

Sem	Actividad tipo 1	Actividad tipo 2	Tele-enseñanza	Actividades de evaluación
1	Chapter 1.1. Software Quality Definition Duración: 02:00 LM: Actividad del tipo Lección Magistral			
2	Chapter 1.2 Software Quality Models Duración: 02:00 LM: Actividad del tipo Lección Magistral			Reading 1 test ET: Técnica del tipo Prueba Telemática Evaluación Progresiva No presencial Duración: 00:00
3	Chapter 1.2 Software Quality Models Chapter 1.3 Usage of a Quality Model Duración: 02:00 LM: Actividad del tipo Lección Magistral			Analysis of a quality attribute TI: Técnica del tipo Trabajo Individual Evaluación Progresiva No presencial Duración: 00:00
4	Chapter 1.4 Defects and Defect Density Duración: 02:00 LM: Actividad del tipo Lección Magistral			Reading 2 test ET: Técnica del tipo Prueba Telemática Evaluación Progresiva No presencial Duración: 00:00
5	Chapter 2.1 Static Controls Duración: 02:00 LM: Actividad del tipo Lección Magistral			Analysis of a defect tracking tool TG: Técnica del tipo Trabajo en Grupo Evaluación Progresiva No presencial Duración: 00:00
6	Inspection practice Duración: 02:00 OT: Otras actividades formativas / Evaluación			Inspection practice TG: Técnica del tipo Trabajo en Grupo Evaluación Progresiva Presencial Duración: 02:00
7	Walkthrough practice Duración: 02:00 OT: Otras actividades formativas / Evaluación			Inspection report TI: Técnica del tipo Trabajo Individual Evaluación Progresiva No presencial Duración: 00:00 Walkthrough practice TG: Técnica del tipo Trabajo en Grupo Evaluación Progresiva Presencial Duración: 02:00
8	Chapter 2.2 Dynamic Controls Duración: 02:00 LM: Actividad del tipo Lección Magistral			Walkthrough report TG: Técnica del tipo Trabajo en Grupo Evaluación Progresiva No presencial Duración: 00:00



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9	Chapter 2.2 Dynamic Controls Duración: 02:00 LM: Actividad del tipo Lección Magistral			Reading 3 test ET: Técnica del tipo Prueba Telemática Evaluación Progresiva No presencial Duración: 00:00
10	Chapter 3. Quality Metrics Duración: 01:00 LM: Actividad del tipo Lección Magistral First partial exam Duración: 01:00 OT: Otras actividades formativas / Evaluación			First Partial exam EX: Técnica del tipo Examen Escrito Evaluación Progresiva Presencial Duración: 01:00
11	Chapter 4. Quality Management Duración: 02:00 LM: Actividad del tipo Lección Magistral			Reading 4 test ET: Técnica del tipo Prueba Telemática Evaluación Progresiva No presencial Duración: 00:00
12	Chapter 4. Quality Management Duración: 01:00 LM: Actividad del tipo Lección Magistral Chapter 5. Quality Assurance Duración: 01:00 LM: Actividad del tipo Lección Magistral			
13	Chapter 6. Software Configuration Management Duración: 02:00 LM: Actividad del tipo Lección Magistral			Analysis of basic quality management tools TG: Técnica del tipo Trabajo en Grupo Evaluación Progresiva No presencial Duración: 00:00
14	Chapter 6. Software Configuration Management Duración: 02:00 LM: Actividad del tipo Lección Magistral			Configuration Management exercises TI: Técnica del tipo Trabajo Individual Evaluación Progresiva No presencial Duración: 00:00
15	Presentation of work on basic quality management tools Duración: 02:00 AC: Actividad del tipo Acciones Cooperativas Second partial exam Duración: 02:00 OT: Otras actividades formativas / Evaluación			Presentation of work on basic quality management tools PG: Técnica del tipo Presentación en Grupo Evaluación Progresiva Presencial Duración: 02:00 Second partial exam EX: Técnica del tipo Examen Escrito Evaluación Progresiva Presencial Duración: 02:00
				Individual exercises (submitted after the deadline for progressive evaluation, or failed and re-submitted) TI: Técnica del tipo Trabajo Individual Evaluación Global No presencial Duración: 00:00 Student participation OT: Otras técnicas evaluativas Evaluación Progresiva Presencial Duración: 00:00



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16				First partial exam (if the grade obtained in progressive evaluation is below the minimum of 4) EX: Técnica del tipo Examen Escrito Evaluación Global Presencial Duración: 02:00 Reading tests ET: Técnica del tipo Prueba Telemática Evaluación Global No presencial Duración: 00:00 Group exercises (submitted after the deadline for progressive evaluation, or failed and re-submitted) TG: Técnica del tipo Trabajo en Grupo Evaluación Global No presencial Duración: 00:00
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Para el cálculo de los valores totales, se estima que por cada crédito ECTS el alumno dedicará dependiendo del plan de estudios, entre 26 y 27 horas de trabajo presencial y no presencial.



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6. Actividades y criterios de evaluación

6.1. Actividades de evaluación de la asignatura

6.1.1. Evaluación (progresiva)

Sem.	Descripción	Modalidad	Tipo	Duración	Peso en la nota	Nota mínima	Competencias evaluadas
2	Reading 1 test	ET: Técnica del tipo Prueba Telemática	No Presencial	00:00	2.5%	/ 10	CG12
3	Analysis of a quality attribute	TI: Técnica del tipo Trabajo Individual	No Presencial	00:00	7%	/ 10	CE7 CG12 CG18
4	Reading 2 test	ET: Técnica del tipo Prueba Telemática	No Presencial	00:00	2.5%	/ 10	CG12
5	Analysis of a defect tracking tool	TG: Técnica del tipo Trabajo en Grupo	No Presencial	00:00	7%	/ 10	CG2 CG3 CG12 CG18 CG1 CE11
6	Inspection practice	TG: Técnica del tipo Trabajo en Grupo	Presencial	02:00	7%	/ 10	CE7 CG1 CE6
7	Inspection report	TI: Técnica del tipo Trabajo Individual	No Presencial	00:00	3%	/ 10	CG2 CG3 CG18 CG1
7	Walkthrough practice	TG: Técnica del tipo Trabajo en Grupo	Presencial	02:00	6%	/ 10	CG3 CG12
8	Walkthrough report	TG: Técnica del tipo Trabajo en Grupo	No Presencial	00:00	2%	/ 10	CG12 CG18 CG1



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9	Reading 3 test	ET: Técnica del tipo Prueba Telemática	No Presencial	00:00	2.5%	/ 10	CG12 CE1
10	First Partial exam	EX: Técnica del tipo Examen Escrito	Presencial	01:00	20%	4 / 10	CE6 CE7 CE1
11	Reading 4 test	ET: Técnica del tipo Prueba Telemática	No Presencial	00:00	2.5%	/ 10	CG12
13	Analysis of basic quality management tools	TG: Técnica del tipo Trabajo en Grupo	No Presencial	00:00	7%	/ 10	CG19 CE1
14	Configuration Management exercises	TI: Técnica del tipo Trabajo Individual	No Presencial	00:00	3%	/ 10	CE11
15	Presentation of work on basic quality management tools	PG: Técnica del tipo Presentación en Grupo	Presencial	02:00	3%	/ 10	CG3 CG18
15	Second partial exam	EX: Técnica del tipo Examen Escrito	Presencial	02:00	20%	4 / 10	CE6 CE7 CG12 CG1 CG19 CE1 CE11
16	Student participation	OT: Otras técnicas evaluativas	Presencial	00:00	5%	/ 10	

6.1.2. Prueba evaluación global

Sem	Descripción	Modalidad	Tipo	Duración	Peso en la nota	Nota mínima	Competencias evaluadas
16	Individual exercises (submitted after the deadline for progressive evaluation, or failed and re-submitted)	TI: Técnica del tipo Trabajo Individual	No Presencial	00:00	13%	/ 10	CG2 CE7 CG3 CG12 CG18 CG1 CG19 CE11



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16	First partial exam (if the grade obtained in progressive evaluation is below the minimum of 4)	EX: Técnica del tipo Examen Escrito	Presencial	02:00	20%	4 / 10	CE6 CG2 CE7 CG3 CG12 CG1 CG19 CE1 CE11
16	Reading tests	ET: Técnica del tipo Prueba Telemática	No Presencial	00:00	10%	/ 10	CG12
16	Group exercises (submitted after the deadline for progressive evaluation, or failed and re-submitted)	TG: Técnica del tipo Trabajo en Grupo	No Presencial	00:00	14%	/ 10	CG2 CG3 CG12 CG18 CG1 CG19 CE11

6.1.3. Evaluación convocatoria extraordinaria

Descripción	Modalidad	Tipo	Duración	Peso en la nota	Nota mínima	Competencias evaluadas
Extraordinary evaluation exam	EX: Técnica del tipo Examen Escrito	Presencial	02:00	40%	4 / 10	CE6 CE7 CG12 CE1 CE11
Reading tests	ET: Técnica del tipo Prueba Telemática	Presencial	12:00	10%	/ 10	CG12
Group exercises (grade obtained in ordinary evaluation, or new submission - see conditions for submission)	TG: Técnica del tipo Trabajo en Grupo	Presencial	00:00	14%	/ 10	CG2 CG3 CG12 CG18 CG1 CG19 CE11



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Individual exercises (grade obtained in ordinary evaluation, or new submission - see conditions for submission)	TI: Técnica del tipo Trabajo Individual	Presencial	00:00	13%	/ 10	CE7 CG3 CG2 CG12 CG18 CG1 CG19
Student participation (grade obtained in progressive evaluation)	OT: Otras técnicas evaluativas	Presencial	00:00	5%	/ 10	

6.2. Criterios de evaluación

Course evaluation system:

The course is graded following a progressive assessment method.

The student passes the course in ordinary evaluation only if:

- 5 or more points over 10 are obtained at the end of the course, by applying the formula:

FINAL GRADE = 40% Individual and group exercises + 15% Reading tests in Moodle + 40% Exams + 5% Student participation

- A minimum grade of 4 over 10 is obtained in each of the partial exams

The maximum grade for each of the evaluation components and the minimum grade needed to compensate non-passed parts are indicated in the following table.

	MAXIMUM GRADE (and correspondence over the final grade)	MINIMUM GRADE TO COMPENSATE NON-PASSED PARTS
Individual and group exercises (45%)	10 (4,5)	4 over 10
Reading tests (10%). Grade computed as the average of the grade obtained in all reading tests.	10 (1,0)	-



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Exams (40%). Grade computed as the average of the grade obtained in both exams.	10 (4,0)	4 over 10
Student participation (5%). Grade obtained through regular attendance to the classes, and active participation in them.	10 (0,5)	

The grade for the Individual and group exercises component will be obtained through the following evaluation activities:

Individual exercises

- Analysis of a quality attribute. Impact on the final grade: 0,7
- Inspection practice. Impact on the final grade: 0,7. THIS ACTIVITY IS PERFORMED IN THE CLASSROOM AND CANNOT BE RECOVERED IN THE GLOBAL EVALUATION
- Analysis of inspection results. Impact on the final grade: 0,3.
- Configuration management exercises. Impact on the final grade: 0,3.

Group exercises

- Analysis of a defect tracking tool. Impact on the final grade: 0,7
- Walkthrough practice. Impact on the final grade: 0,8. THIS ACTIVITY IS PERFORMED IN THE CLASSROOM AND CANNOT BE RECOVERED IN THE GLOBAL EVALUATION
- Analysis of a basic quality management tool. Impact on the final grade: 0,7.
- Presentation of the analysis of a basic quality management tool. Impact on the final grade: 0,3. THIS ACTIVITY IS PERFORMED IN THE CLASSROOM AND CANNOT BE RECOVERED IN THE GLOBAL EVALUATION

Global evaluation

When failed (grade below the minimum), the first partial exam should be repeated in the global evaluation date fixed in the exam calendar.

The individual and group exercises submitted after the deadline established for the progressive evaluation will be considered as submitted to the global evaluation, and consequently they will be graded at the end of the semester, without the possibility to re-submit them at the global evaluation period.



The individual and group exercises submitted before the deadline established for the progressive evaluation will be graded and, if failed (grade below the minimum), the student will be allowed to re-submit them at the global evaluation period, although re-submission is not mandatory to pass the course.

Some evaluation activities can only be performed in a progressive way, namely:

- Inspection practice. Impact on the final grade: 0,7.
- Walkthrough practice and report. Impact on the final grade: 0,8.
- Presentation of the analysis of a basic quality management tool. Impact on the final grade: 0,3.

Attendance to the classes in which these activities are performed is mandatory. The dates for these classes will be announced at least 14 days in advance. Students not attending these classes will be graded as 0 in the corresponding evaluation activities, without the possibility to pass them either in the global or in the extraordinary evaluation.

The Student participation will also be graded only progressively, and it will depend on attendance to the classes and active participation in the discussions. Impact on the final grade: 0,5.

Extraordinary evaluation

When failed (grade below the minimum), any of the partial exams should be repeated in the extraordinary evaluation date fixed in the exam calendar.

Only the individual and group exercises not submitted for the ordinary evaluation (progressive or global) can be submitted for the extraordinary evaluation. For all submitted exercises, the grades obtained in ordinary evaluation will be considered for the computation of the final grade.



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7. Recursos didácticos

7.1. Recursos didácticos de la asignatura

Nombre	Tipo	Observaciones
Schulmeyer, 2007	Bibliografía	Gordon Schulmeyer, G. (2007) Handbook of Software Quality Assurance, Artech House Publishers, 4th ed.
Fagan, 1976	Bibliografía	M.E. Fagan, Design and Code Inspections to Reduce Errors in Program Development, IBM Systems Journal, Vol. 15, N° 3, pp. 182-210, 1976
Galin, 2003	Bibliografía	D. Galin (2003) Software Quality Assurance: From Theory to Implementation, Addison-Wesley
McCall, 1977	Bibliografía	J.A. McCall, P.K. Richards, G.F. Walters, Factors in Software Quality, RADC-TR-77-369, Rome Air Development Center, United States Air Force, 1977
Cianfrani, 2009	Bibliografía	C.A. Cianfrani, J.J. Tsiakals, J.E. West (2009) ISO 9001:2008 Explained, ASQ Quality Press
ISO/IEC 9126-1:2001	Bibliografía	ISO/IEC 9126-1:2001, Software engineering -- Product quality -- Part 1: Quality model
ISO/IEC TR 9126-2:2003	Bibliografía	ISO/IEC TR 9126-2:2003, Software engineering -- Product quality -- Part 2: External metrics
ISO/IEC TR 9126-3:2003	Bibliografía	ISO/IEC TR 9126-3:2003, Software engineering -- Product quality -- Part 3: Internal metrics
ISO/IEC TR 9126-4:2004	Bibliografía	ISO/IEC TR 9126-4:2004, Software engineering -- Product quality -- Part 4: Quality in use metrics



IEEE 983-86	Bibliografía	IEEE Guide for Software Quality Assurance Planning, ANSI/IEEE std. 983-1986, IEEE Computer Society, Software Engineering Technical Committee, Software Engineering Standards Subcommittee, 1986
IEEE 1028-2008	Bibliografía	IEEE Standard for Software Reviews and Audits, ANSI/IEEE IEEE std. 1028-2008, IEEE Computer Society, Software Engineering Technical Committee, Software Engineering Standards Subcommittee, 2008
The how and why of auditing	Recursos web	http://videos.asq.org/the-how-and-why-of-auditing
Guidelines for the Application of ISO 9001:2000 to Computer Software	Bibliografía	IEEE Guide Adoption of ISO/IEC 90003:2004 Software Engineering -Guidelines for the Application of ISO 9001:2000 to Computer Software
Subject web site	Recursos web	https://moodle.upm.es/titulaciones/oficiales/course/view.php?id=2999

8. Otra información

8.1. Otra información sobre la asignatura

8.4 Advanced Software Engineering Aspects Module

8.4.1 Adaptive Systems



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SUBJECT

103000739 - Adaptive Systems

DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

ACADEMIC YEAR & SEMESTER

2025/26 - Semester 1



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1. Description

1.1. Subject details

Name of the subject	103000739 - Adaptive Systems
No of credits	4 ECTS
Type	Optional/elective
Academic year of the programme	First year
Semester of tuition	Semester 1
Tuition period	September-January
Tuition languages	English
Degree programme	10AM - Master Universitario en Ingeniería del Software
Centre	10 - E.T.S. De Ingenieros Informáticos
Academic year	2025-26

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Angelica De Antonio Jimenez	5108	angelica.deantonio@upm.es	M - 10:30 - 14:00 Th - 09:30 - 12:00
Jaime Ramirez Rodriguez (Subject coordinator)	5109	jaime.ramirez@upm.es	Sin horario. The tutoring table can be found at: https://dlsiis.fi.upm.es/tutorias-2526

* The tutoring schedule is indicative and subject to possible changes. Please check tutoring times with the faculty member in charge.



3. Prior knowledge recommended to take the subject

3.1. Recommended (passed) subjects

The subject - recommended (passed), are not defined.

3.2. Other recommended learning outcomes

- Computer programming

4. Skills and learning outcomes *

4.1. Skills to be learned

CE13 - Tener una visión de los distintos aspectos específicos y emergentes de la ingeniería del software, y profundizar en algunos de ellos

CE14 - Comprender lo que pueden y no pueden conseguir las prácticas actuales de ingeniería del software, y sus limitaciones y su posible futura evolución.

CG13 - Apreciación de los límites del conocimiento actual y de la aplicación práctica de la tecnología más reciente

CG18 - Capacidad de trabajar y comunicarse también en contextos internacionales

CG3 - Que los estudiantes sepan comunicar sus conclusiones y los conocimientos y razones últimas que las sustentan a públicos especializados y no especializados de un modo claro y sin ambigüedades (RD)



CG8 - Planteamiento y resolución de problemas también en áreas nuevas y emergentes de su disciplina

CG9 - Aplicación de los métodos de resolución de problemas más recientes o innovadores y que puedan implicar el uso de otras disciplinas

4.2. Learning outcomes

RA88 - Knowledge of Methods for student modelling and individualized and adapted interaction with learning systems

RA89 - Model the user and to design adaptive user interfaces based on the user

* The Learning Guides should reflect the Skills and Learning Outcomes in the same way as indicated in the Degree Verification Memory. For this reason, they have not been translated into English and appear in Spanish.

5. Brief description of the subject and syllabus

5.1. Brief description of the subject

Interaction design methods focused on providing the same content to all users offer limited possibilities in addressing the specific needs and requirements of different types of users. Therefore, an essential feature of certain interactive applications should be their ability to provide some form of automatic adaptation and customization. The main objective of this course is to achieve an understanding of the models, techniques and architectures necessary to make a computer application dynamically adapt to the specific needs and requirements of different types of users at all times.

Adaptive systems maintain a model of the interests, preferences and / or knowledge of each individual user, and use this model to adapt the behavior of the systems to the needs of that user.

This course will cover the main components of the user model in the context of adaptive systems. And within the adaptive systems, the personalized search systems on the Web will be addressed first and it will be explained how these systems are supported by the user model.

Recommendation systems have become essential tools in many areas of application, because they help alleviate information overload as they select the most appropriate content for each user based on their preferences and / or interests. In this sense, these types of systems help users in decision-making by providing personalized services and help information providers and companies to serve customers more effectively.

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In this course, the general characteristics of the recommendation systems will be explained and a classification of these systems will be presented according to the type of techniques they use to generate the recommendations. According to this classification, we will distinguish between content-based, collaborative filtering, and hybrid recommenders. Following this, an introduction will be given to the main techniques on which each of these groups of recommenders are based, highlighting the strengths and weaknesses of each group.

E-learning is a traditional domain for the application of personalization and adaptation technologies. One of the main objectives of these applications is to improve the effectiveness and efficiency of learning experiences. The last topic of the course will be about adaptive e-learning systems paying special attention to intelligent tutoring systems.

5.2. Syllabus

1. User Modeling for Adaptive Systems and Adaptive Web
2. Recommender Systems
 - 2.1. Content based Recommender Systems
 - 2.2. Collaborative Filter based Recommender Systems
 - 2.3. Context aware Recommender Systems
 - 2.4. Deep learning applied to Recommender Systems
3. Technology-enhanced adaptive learning



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6. Schedule

6.1. Subject schedule*

Week	Type 1 activities	Type 2 activities	Distant / On-line	Assessment activities
1	Presentation of the subject Duration: 02:00 Lecture			Classroom Participation grade Other assessment Progressive assessment Presential Duration: 00:00
2	User modeling for Adaptive Systems and Adaptive Web Duration: 02:00 Lecture			Classroom Participation grade Other assessment Progressive assessment Presential Duration: 00:00
3	Recommender Systems Duration: 02:00 Lecture			Classroom Participation grade Other assessment Progressive assessment Presential Duration: 00:00
4	Recommender Systems Duration: 02:00 Lecture			Classroom Participation grade Other assessment Progressive assessment Presential Duration: 00:00
5	Recommender Systems Duration: 02:00 Lecture			Exam 1 Online test Progressive assessment and Global Examination Not Presential Duration: 01:00 Classroom Participation grade Other assessment Progressive assessment Presential Duration: 00:00
6	Workshop associated with practical exercise 1 Duration: 02:00 Laboratory assignments			Practical exercise 1 Group work Progressive assessment and Global Examination Not Presential Duration: 07:00 Classroom Participation grade Other assessment Progressive assessment Presential Duration: 00:00



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7	Recommender Systems Duration: 02:00 Lecture			Practical exercise 1 Group work Progressive assessment and Global Examination Not Presential Duration: 07:00 Classroom Participation grade Other assessment Progressive assessment Presential Duration: 00:00
8	Recommender Systems Duration: 02:00 Lecture			Practical exercise 1 Group work Progressive assessment and Global Examination Not Presential Duration: 20:00 Classroom Participation grade Other assessment Progressive assessment Presential Duration: 00:00
9	Workshop associated with practical exercise 2 Duration: 02:00 Laboratory assignments			Practical exercise 2 Group work Progressive assessment and Global Examination Not Presential Duration: 20:00 Classroom Participation grade Other assessment Progressive assessment Presential Duration: 00:00
10	Recommender Systems Duration: 02:00 Lecture			Practical exercise 2 Group work Progressive assessment and Global Examination Not Presential Duration: 10:00 Classroom Participation grade Other assessment Progressive assessment Presential Duration: 00:00
11	Recommender Systems Duration: 02:00 Lecture			Practical exercise 2 Group work Progressive assessment and Global Examination Not Presential Duration: 10:00 Classroom Participation grade Other assessment Progressive assessment Presential Duration: 00:00



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12	Technology-enhanced adaptive learning Duration: 02:00 Lecture			Classroom Participation grade Other assessment Progressive assessment Presential Duration: 00:00 Exam 2 Online test Progressive assessment and Global Examination Not Presential Duration: 01:00
13	Technology-enhanced adaptive learning Duration: 02:00 Lecture			Classroom Participation grade Other assessment Progressive assessment Presential Duration: 00:00
14	Technology-enhanced adaptive learning Duration: 01:00 Problem-solving class Technology-enhanced adaptive learning Duration: 01:00 Lecture			Classroom Participation grade Other assessment Progressive assessment Presential Duration: 00:00
15	Technology-enhanced adaptive learning (student presentations) Duration: 01:30 Additional activities Technology-enhanced adaptive learning Duration: 00:30 Problem-solving class			Design of Adaptive Tutoring System Group work Progressive assessment Not Presential Duration: 00:00 Classroom Participation grade Other assessment Progressive assessment Presential Duration: 00:00 Technology-enhanced adaptive learning (student presentations) Group work Progressive assessment Presential Duration: 01:30
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Depending on the programme study plan, total values will be calculated according to the ECTS credit unit as 26/27 hours of student face-to-face contact and independent study time.



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7. Activities and assessment criteria

7.1. Assessment activities

7.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
1	Classroom Participation grade	Other assessment	Face-to-face	00:00	.33%	0 / 10	CG9 CG13 CG3 CG8 CG18 CE13
2	Classroom Participation grade	Other assessment	Face-to-face	00:00	.33%	0 / 10	CG9 CG13 CG3 CG8 CG18 CE13
3	Classroom Participation grade	Other assessment	Face-to-face	00:00	.33%	0 / 10	CG9 CG13 CG3 CG8 CG18 CE13
4	Classroom Participation grade	Other assessment	Face-to-face	00:00	.33%	0 / 10	CG9 CG13 CG3 CG8 CG18 CE13
5	Exam 1	Online test	No Presential	01:00	5%	0 / 10	CG13 CE14 CE13
5	Classroom Participation grade	Other assessment	Face-to-face	00:00	.33%	0 / 10	CG9 CG13 CG3 CG8 CG18 CE13

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6	Practical exercise 1	Group work	No Presential	07:00	5%	5 / 10	CG13 CE14 CG3 CE13
6	Classroom Participation grade	Other assessment	Face-to-face	00:00	.33%	0 / 10	CG9 CG13 CG3 CG8 CG18 CE13
7	Practical exercise 1	Group work	No Presential	07:00	5%	5 / 10	CG13 CE14 CG3 CE13
7	Classroom Participation grade	Other assessment	Face-to-face	00:00	.33%	0 / 10	CG9 CG13 CG3 CG8 CG18 CE13
8	Practical exercise 1	Group work	No Presential	20:00	15%	5 / 10	CG13 CE14 CG3 CE13
8	Classroom Participation grade	Other assessment	Face-to-face	00:00	.33%	0 / 10	CG9 CG13 CG3 CG8 CG18 CE13
9	Practical exercise 2	Group work	No Presential	20:00	20%	5 / 10	CG9 CG13 CE14 CG8 CG18 CE13
9	Classroom Participation grade	Other assessment	Face-to-face	00:00	.33%	0 / 10	CG9 CG13 CG3 CG8 CG18 CE13
10	Practical exercise 2	Group work	No Presential	10:00	10%	5 / 10	CG9 CG13 CE14 CG8 CG18 CE13



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10	Classroom Participation grade	Other assessment	Face-to-face	00:00	.33%	0 / 10	CG9 CG13 CG3 CG8 CG18 CE13
11	Practical exercise 2	Group work	No Presential	10:00	5%	5 / 10	CG9 CG13 CE14 CG8 CG18 CE13
11	Classroom Participation grade	Other assessment	Face-to-face	00:00	.33%	0 / 10	CG9 CG13 CG3 CG8 CG18 CE13
12	Classroom Participation grade	Other assessment	Face-to-face	00:00	.33%	0 / 10	CG9 CG13 CG3 CG8 CG18 CE13
12	Exam 2	Online test	No Presential	01:00	5%	0 / 10	CG9 CG13 CE14 CE13
13	Classroom Participation grade	Other assessment	Face-to-face	00:00	.33%	0 / 10	CG9 CG13 CG3 CG8 CG18 CE13
14	Classroom Participation grade	Other assessment	Face-to-face	00:00	.33%	0 / 10	CG9 CG13 CG3 CG8 CG18 CE13
15	Design of Adaptive Tutoring System	Group work	No Presential	00:00	12.5%	5 / 10	CE14 CG18 CE13 CG9 CG13
15	Classroom Participation grade	Other assessment	Face-to-face	00:00	.38%	0 / 10	



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15	Technology-enhanced adaptive learning (student presentations)	Group work	Face-to-face	01:30	12.5%	5 / 10	CG13 CE14 CG3 CE13
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7.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
5	Exam 1	Online test	No Presential	01:00	5%	0 / 10	CG13 CE14 CE13
6	Practical exercise 1	Group work	No Presential	07:00	5%	5 / 10	CG13 CE14 CG3 CE13
7	Practical exercise 1	Group work	No Presential	07:00	5%	5 / 10	CG13 CE14 CG3 CE13
8	Practical exercise 1	Group work	No Presential	20:00	15%	5 / 10	CG13 CE14 CG3 CE13
9	Practical exercise 2	Group work	No Presential	20:00	20%	5 / 10	CG9 CG13 CE14 CG8 CG18 CE13
10	Practical exercise 2	Group work	No Presential	10:00	10%	5 / 10	CG9 CG13 CE14 CG8 CG18 CE13
11	Practical exercise 2	Group work	No Presential	10:00	5%	5 / 10	CG9 CG13 CE14 CG8 CG18 CE13
12	Exam 2	Online test	No Presential	01:00	5%	0 / 10	CG9 CG13 CE14 CE13

7.1.3. Referred (re-sit) examination



Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Practical exercise 1	Individual work	Face-to-face	20:00	30%	5 / 10	CG9 CG13 CE14 CG3 CG8 CG18 CE13
Design of Adaptive Tutoring System	Individual work	Face-to-face	02:00	12.5%	5 / 10	CG13 CE14 CE13
Practical exercise 2	Individual work	Face-to-face	40:00	45%	5 / 10	CG9 CG13 CE14 CG3 CG8 CG18 CE13
Research topic analysis	Individual work	Face-to-face	00:00	12.5%	5 / 10	CE14 CG3 CE13 CG9 CG13

7.2. Assessment criteria

1. Regular Period

1.1. Distributed evaluation

The final grade (FG) will be calculated from the grades of the Practical Exercises (PEG1, PE2G), the Exam grade (EG), the Classroom Participation grade (CPG), the grade of the Design of Adaptive Tutoring System (DTG), and the Research Topic Analysis grade (RTG) by means of the following formula:

$$FG = 0.25 \cdot PEG1 + 0.35 \cdot PEG2 + 0.10 \cdot EG + 0.125 \cdot RTG + 0.125 \cdot DTG + 0.05 \cdot CPG$$

Where all the grades take values between 0 and 10.

The Exam grade is the average of the grades obtained in the two exams.



The classroom participation grade stands for the ratio of attendance multiplied by 10. Additionally, **students will have to attend some prefixed classes associated with evaluation activities, which will be reported at least 15 days prior to the day of the evaluation activity.**

The grades obtained in the passed parts of the subject will be recorded for the global evaluation and the Extraordinary period if needed.

1.2. Global evaluation

If the student fails to pass the exam grade of the distributed evaluation, he/she will have a second chance in the global evaluation by doing a remedial exam, which will determine the exam grade (EG) of the regular period.

If the student fails to pass some of the practical exercises, he/she will have a second chance in the global evaluation to submit the failed practical exercises.

However, given the proximity of the deadline of the research topic analysis and the Design of the Adaptive Tutoring to the global evaluation, it does not make sense that students can submit these assignments in the global evaluation.

2. Extraordinary Period

When failed, in the extraordinary period the final grade will be obtained from the grades of the Practical Exercises (30% + 45%), the grade of the Design of Adaptive Tutoring System (12.5%), and the Research Topic Analysis grade (12.5%).



8. Teaching resources

8.1. Teaching resources for the subject

Name	Type	Notes
Article	Bibliography	Brusilovsky, Peter, and Eva Millán. 2007. "User Models for Adaptive Hypermedia and Adaptive Educational Systems". The Adaptive Web, 3-53. doi:10.1007/978-3-540-72079-9_1.
book	Bibliography	Ricci, Francesco, Lior Rokach, and Bracha Shapira. 2015. Recommender Systems Handbook. Springer-Verlag. Vol. 54. doi:10.1007/978-0-387-85820-3.
book 2	Bibliography	Brusilovsky, Peter, Alfred Kobsa, and Wolfgang Nejdl. 2007. The Adaptive Web: Methods and Strategies of Web Personalization. The Adaptive Web. Vol. 4321. doi:10.1007/978-3-540-72079-9.
Article 2	Bibliography	O'Donnell, E., Lawless, S., Sharp, M., Wade, V. (2015) A Review of Personalised E-Learning: Towards Supporting Learner Diversity. International Journal of Distance Education Technologies, 13(1), 22-47, January-March 2015
book 3	Bibliography	K. Falk. Practical Recommender Systems. 2019. Publisher: Manning Publications



9. Other information

9.1. Other information about the subject

To contact professors, students can use their email addresses included in this document or a Moodle message.

Professors will publish the teaching materials (slides, assignments, etc.) they use throughout the course on the Moodle site of the subject. Additionally, professors will use the Moodle forum to announce key events and provide relevant information on the subject.

Several innovative teaching methodologies are implemented in this course (<https://innovacioneducativa.upm.es/guias-pdi>) with the goal of motivating and reinforcing student learning:

- **Project-Based Learning:** This is a learning methodology in which students, working in small groups, are asked to plan, create, and evaluate a project that addresses the needs presented in a given situation.
- **Learning by Doing:** This is an approach that gives students an active role in the tasks to be carried out, granting them autonomy to resolve the given situation or problem.
- **Problem-Based Learning:** Students, working in teams, are required to complete two programming assignments based on real-world problems. They must apply the knowledge acquired in the course to solve these problems under the supervision of the instructors. Both assignments begin with two workshops in the classroom, respectively, in which the professor clarifies the goals of the assignments and provides support with technical issues.

8.4.2 Agile Software Development: Agile Practices and Agile Usability



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SUBJECT

103000545 - Agile Software Development: Agile Practices And Agile Usability

DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

ACADEMIC YEAR & SEMESTER

2025/26 - Semester 1



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1. Description

1.1. Subject details

Name of the subject	103000545 - Agile Software Development: Agile Practices And Agile Usability
No of credits	4 ECTS
Type	Optional/elective
Academic year of the programme	First year
Semester of tuition	Semester 1
Tuition period	September-January
Tuition languages	English
Degree programme	10AM - Master Universitario en Ingeniería del Software
Centre	10 - E.T.S. De Ingenieros Informáticos
Academic year	2025-26

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Ana Maria Moreno Sanchez-Capuchino (Subject coordinator)	5102	anamaria.moreno@upm.es	M - 15:00 - 21:00
Tomas San Feliu Gilabert	D5105	tomas.sanfeliu@upm.es	Tu - 10:00 - 14:00 Th - 10:00 - 14:00

* The tutoring schedule is indicative and subject to possible changes. Please check tutoring times with the faculty member in charge.



3. Skills and learning outcomes *

3.1. Skills to be learned

CE13 - Tener una visión de los distintos aspectos específicos y emergentes de la ingeniería del software, y profundizar en algunos de ellos

CG18 - Capacidad de trabajar y comunicarse también en contextos internacionales

CG3 - Que los estudiantes sepan comunicar sus conclusiones y los conocimientos y razones últimas que las sustentan a públicos especializados y no especializados de un modo claro y sin ambigüedades (RD)

CG9 - Aplicación de los métodos de resolución de problemas más recientes o innovadores y que puedan implicar el uso de otras disciplinas

3.2. Learning outcomes

RA24 - Conflict solving capability SC13, SC14, CG18 C

RA26 - Group work skill SC13, SC14, CG17 A

RA25 - Communication skills in public SC13, SC14, CG3, CG18 S

RA23 - Time organization capability SC13, SC14 K

RA11 - Understands the interrelation between product quality and process quality

RA27 - Negotiation skill SC13, SC14, CG18 C

RA14 - The student will be able to design a software system according to requirements, restrictions, quality standards, and developer criteria

* The Learning Guides should reflect the Skills and Learning Outcomes in the same way as indicated in the Degree Verification Memory. For this reason, they have not been translated into English and appear in Spanish.



4. Brief description of the subject and syllabus

4.1. Brief description of the subject

This subject provides an overview of the agile development process. We will review the main differences with traditional development and how agile practices can be used to solve some important lacks in classical methods.

We will pay special attention to agile usability as a new approximation to improve the user experience in agile developments

We will work in agile teams to build a software product according to the previous practices and methods.

4.2. Syllabus

1. Fundamentals of Agile Development
2. Agile Artifacts
3. Description of Agile Methods
4. Agile Usability - Lean UX
5. Agile UX Project



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5. Schedule

5.1. Subject schedule*

Week	Type 1 activities	Type 2 activities	Distant / On-line	Assessment activities
1	Unit 1. Agile Fundamentals Duration: 02:00 Cooperative activities			
2	Unit 2. Agile Artifacts Duration: 02:00 Cooperative activities			
3	Unit 3. Description of Agile Methods Duration: 02:00 Inverted classroom			
4	Unit 3. Description of Agile Methods (Serious Game) Duration: 02:00 Gamification			
5	Unit 3. Description of Agile Methods Duration: 02:00 Inverted classroom			
6	Unit 4. Agile Usability - Lean UX Duration: 02:00 Inverted classroom			
7	Unit 4. Agile Usability - Lean UX Duration: 02:00 Inverted classroom			
8	Unit 4. Agile Usability Duration: 02:00 Problem-solving class			
9	Unit 4. Agile Usability Duration: 02:00 Problem-solving class			
10	Unit 4. Agile Usability Duration: 02:00 Problem-solving class			
11	Unit 5. Agile UX Project Duration: 02:00 Cooperative activities			
12	Unit 5. Agile UX Project Duration: 02:00 Additional activities			Presentation of Project Group presentation Progressive assessment Presential Duration: 02:00
13	Unit 5. Agile UX Project Duration: 02:00 Additional activities			Presentation of Project Group presentation Progressive assessment Presential Duration: 02:00



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14	Unit 5. Agile UX Project Duration: 02:00 Additional activities			Presentation of Project Group presentation Progressive assessment Presential Duration: 02:00
15	Unit 5. Agile UX Project Duration: 02:00 Additional activities			Presentation of Project Group presentation Progressive assessment Presential Duration: 02:00 Active Participation of Students Other assessment Progressive assessment Not Presential Duration: 00:00 Content of Project Report Group work Progressive assessment Not Presential Duration: 00:00 Active Participation of Students Other assessment Global examination Not Presential Duration: 00:00
16	Seminar Duration: 02:00 Cooperative activities			
17				Content of the Project Report Individual work Global examination Not Presential Duration: 00:00 Presentation of Project Individual presentation Global examination Presential Duration: 02:00

Depending on the programme study plan, total values will be calculated according to the ECTS credit unit as 26/27 hours of student face-to-face contact and independent study time.



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6. Activities and assessment criteria

6.1. Assessment activities

6.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
12	Presentation of Project	Group presentation	Face-to-face	02:00	10%	0 / 10	CE13 CG9 CG18 CG3
13	Presentation of Project	Group presentation	Face-to-face	02:00	10%	0 / 10	CE13 CG9 CG18 CG3
14	Presentation of Project	Group presentation	Face-to-face	02:00	10%	0 / 10	CE13 CG9 CG18 CG3
15	Presentation of Project	Group presentation	Face-to-face	02:00	10%	0 / 10	CE13 CG9 CG18 CG3
15	Active Participation of Students	Other assessment	No Presential	00:00	10%	0 / 10	
15	Content of Project Report	Group work	No Presential	00:00	50%	5 / 10	CE13 CG9 CG18 CG3

6.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
15	Active Participation of Students	Other assessment	No Presential	00:00	10%	0 / 10	CE13 CG9 CG18 CG3
17	Content of the Project Report	Individual work	No Presential	00:00	50%	5 / 10	CE13 CG9 CG18 CG3



17	Presentation of Project	Individual presentation	Face-to-face	02:00	40%	5 / 10	CE13 CG9 CG18 CG3
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6.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Content of Project Report	Individual work	Face-to-face	00:00	90%	5 / 10	CE13 CG9 CG18 CG3
Active Participation of Students	Other assessment	Face-to-face	00:00	10%	0 / 10	CE13 CG9 CG18 CG3

6.2. Assessment criteria

During progressive evaluation, the final grade of students will be calculated according to their performance in the project and their class participation.

- Active participation of students (10%)
- Content of report (50%)
- Presentations (10% each)

Students must get a minimum of 5 points in the assessment of the reports in order to pass the matter.

Students must get a minimum of 5 points (over 10) as final grade in order to pass the matter.

During the global evaluation, the final grade of the students will be calculated according to their performance in the project and their class participation. If students have attended to the lecturers during the course, they will be evaluated accordingly in the "Active participation" activity. If not, their grade in the "Active participation" activity will be 0.



- Active participation of students (10%)
- Content of report (50%)
- Presentation (40%)

Students must get a minimum of 5 points in the assessment of the report in order to pass the matter.

Students must get a minimum of 5 points in the assessment of the presentation in order to pass the matter.

Students must get a minimum of 5 points (over 10) as final grade in order to pass the matter.

During the extraordinary evaluation, the final grade of the students will be calculated according to their performance in the project report and their class participation. If students have attended to the lecturers during the course, they will be evaluated accordingly in the "Active participation" activity. If not, their grade in the "Active participation" activity will be 0.

- Active participation of students (10%)
- Content of report (90%)

Students must get a minimum of 5 points in the assessment of the report in order to pass the matter.

Students must get a minimum of 5 points (over 10) as final grade in order to pass the matter.



7. Teaching resources

7.1. Teaching resources for the subject

Name	Type	Notes
Bibliography Agile	Bibliography	A. Cockburn. Agile Software Development, Addison Wesley, 2002
Bibliography Scrum	Web resource	http://scrumtraininginstitute.com/library
Process Agility and Software Usability	Web resource	http://citeseer.ist.psu.edu/465732.html
Agile Ecosystems	Bibliography	J. Higsmith. Agile Software Development Ecosystems. Addison-Wesley, 2005
Lean UX. Designing great products with agile teams	Bibliography	Book by Lean UX authors

8.4.3 Challenges for Accessible Computing for People with Functional Diversity



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SUBJECT

103000603 - Challenges For Accessible Computing For People With Functional Diversity

DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

ACADEMIC YEAR & SEMESTER

2025/26 - Semester 1



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1. Description

1.1. Subject details

Name of the subject	103000603 - Challenges For Accessible Computing For People With Functional Diversity
No of credits	4 ECTS
Type	Optional/elective
Academic year of the programme	First year
Semester of tuition	Semester 1
Tuition period	September-January
Tuition languages	English
Degree programme	10AM - Master Universitario en Ingeniería del Software
Centre	10 - E.T.S. De Ingenieros Informáticos
Academic year	2025-26

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Jose Luis Fuertes Castro (Subject coordinator)	D4307	joseluis.fuertes@upm.es	Tu - 17:00 - 20:00 W - 12:00 - 15:00 Please confirm appointment via email. http://dlsiis.fi.upm.es/tutorias-2526



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M. Carmen Suarez De Figueroa Baonza	D-2201	mdelcarmen.suarezdefigueroa@upm.es	M - 11:00 - 12:00 Tu - 12:00 - 14:00 Th - 14:00 - 17:00 Please confirm appointment via email.
Loic Antonio Martinez Normand	D2303	loic.mnormand@upm.es	Tu - 13:00 - 15:00 Th - 13:00 - 15:00 F - 13:00 - 15:00 Please confirm appointment via email. http://dlsiis.fi.upm.es/tutorias-2526

* The tutoring schedule is indicative and subject to possible changes. Please check tutoring times with the faculty member in charge.

3. Skills and learning outcomes *

3.1. Skills to be learned

CE13 - Tener una visión de los distintos aspectos específicos y emergentes de la ingeniería del software, y profundizar en algunos de ellos

CE14 - Comprender lo que pueden y no pueden conseguir las prácticas actuales de ingeniería del software, y sus limitaciones y su posible futura evolución.

CG13 - Apreciación de los límites del conocimiento actual y de la aplicación práctica de la tecnología más reciente



3.2. Learning outcomes

RA18 - Given a real problem, the student chooses the most appropriate software engineering solution, analyzing the solution feasibility, what can and cannot be achieved through the current status of the chosen solution, and what it can advance in the future.

RA1 - Within an application field of Software Engineering, uses and designs the appropriate solution to solve some of its problems, describing the technical difficulties and the application limits

RA3 - Explains which are the Software Engineering limits and frontiers, and the base of new tendencies and developments and advanced topics and their possible application

* The Learning Guides should reflect the Skills and Learning Outcomes in the same way as indicated in the Degree Verification Memory. For this reason, they have not been translated into English and appear in Spanish.

4. Brief description of the subject and syllabus

4.1. Brief description of the subject

This course provides a specialization about the accessibility of information and communication technologies (ICT) for persons with functional diversity (disability). It is mainly focused on current research issues in the field.

The course deals with an introduction to ICT accessibility concepts: functional diversity, design for all, user centred design, standards and the assessment of the accessibility degree of ICT products and services, cognitive accessibility and future trends in ICT accessibility.

After that, the students will work on current challenges in the field.



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4.2. Syllabus

1. Functional diversity, accessibility and design for all
 - 1.1. Introduction
 - 1.2. Functional diversity
 - 1.3. Assistive products for ICT
 - 1.4. Principles of accessible design
 - 1.5. Introduction to Human-centred design
2. ICT accessibility standards
 - 2.1. Introduction to standards
 - 2.2. Relevant ICT accessibility standards
 - 2.3. Deeper study of one accessibility standard
 - 2.4. Conformity assessment
3. State of the art in ICT accessibility
 - 3.1. State of the art and future trends
4. Cognitive Accessibility
 - 4.1. Introduction to the Easy-to-Read Methodology



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5. Schedule

5.1. Subject schedule*

Week	Type 1 activities	Type 2 activities	Distant / On-line	Assessment activities
1	Course introduction Duration: 00:20 Lecture Chapter 1: 1.1- Introduction Duration: 01:10 Lecture Chapter 1: 1.2- Functional diversity Duration: 00:30 Lecture			
2	Chapter 1: 1.2- Functional diversity Duration: 02:00 Lecture			Personas evaluation Other assessment Progressive assessment Presential Duration: 00:10 Individual presentation of personas Individual presentation Progressive assessment Presential Duration: 00:20
3	Chapter 1: 1.3- Assistive products Duration: 02:00 Lecture			
4	Chapter 1: 1.4- Principles of accessible design Duration: 01:00 Cooperative activities Chapter 1: 1.5- Introduction to human-centred design Duration: 00:30 Lecture Chapter 2: 2.1- Introduction to standards Duration: 00:30 Lecture			Individual presentation of principles of Design for All Individual presentation Progressive assessment Presential Duration: 00:30 Design for All evaluation Other assessment Progressive assessment Presential Duration: 00:10
5	Standards overview discussion Duration: 00:30 Cooperative activities Chapter 2: 2.2- Relevant ICT standards Duration: 00:45 Cooperative activities Chapter 2: 2.3- Deeper study of one accessibility standard Duration: 00:30 Lecture			Test 1 Written test Progressive assessment Not Presential Duration: 00:30 Standard overview evaluation Other assessment Progressive assessment Presential Duration: 00:15



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	Explanation of exercise 1 Duration: 00:15 Lecture			
6	Chapter 2: 2.3- Deeper study of one accessibility standard Duration: 02:00 Cooperative activities			One accessibility standard evaluation (discussion) Individual presentation Progressive assessment and Global Examination Presential Duration: 00:30
7	Chapter 2: 2.3- Deeper study of one accessibility standard Duration: 01:40 Cooperative activities Explanation of exercise 2 Duration: 00:20 Lecture			One accessibility standard evaluation (discussion) Individual presentation Progressive assessment and Global Examination Presential Duration: 00:30 Delivery of exercise 1 Group work Progressive assessment Not Presential Duration: 00:00
8	Chapter 2: 2.4- Conformity assesment Duration: 01:45 Lecture Classroom tutoring. Exercise 2 Duration: 00:15 Additional activities			Conformity assesment evaluation Other assesment Progressive assessment Presential Duration: 00:15
9	Chapter 3: 3.1- State of the art and future trends Duration: 01:45 Lecture Explanation of exercise 3 Duration: 00:15 Lecture			Delivery of exercise 2 Group work Progressive assessment Not Presential Duration: 00:00 State of the art in ICT accessibility evaluation Other assesment Progressive assessment Presential Duration: 00:10
10	Collective revision of exercise 2 Duration: 02:00 Cooperative activities			Participation in evaluation of exercise 2 Individual presentation Progressive assessment Presential Duration: 02:00
11	Chapter 4: Cognitive Accessibility Duration: 01:45 Lecture Explanation of exercise 4 Duration: 00:15 Lecture			Cognitive accessibility evaluation Other assesment Progressive assessment Presential Duration: 00:15



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12	Chapter 4: Cognitive Accessibility Duration: 02:00 Lecture			Cognitive accessibility evaluation Other assessment Progressive assessment Presential Duration: 00:15
13	Group tutoring Duration: 02:00 Additional activities			
14	Classroom discussion about state of the art and future trends Duration: 02:00 Additional activities			Delivery of exercise 4 Group presentation Progressive assessment Not Presential Duration: 00:00 Presentation of exercise 3 Group presentation Progressive assessment and Global Examination Presential Duration: 02:00
15	Classroom discussion about state of the art and future trends Duration: 02:00 Additional activities			Presentation of exercise 3 Group presentation Progressive assessment and Global Examination Presential Duration: 02:00
16				Test 1 Written test Global examination Not Presential Duration: 00:30 Test 2 Written test Progressive assessment and Global Examination Not Presential Duration: 00:30 Delivery of exercise 1 Group work Global examination Not Presential Duration: 00:00 Delivery of exercise 3 Group work Progressive assessment Not Presential Duration: 00:00 Delivery of exercise 3 Group work Global examination Not Presential Duration: 00:00 Delivery of exercise 4 Group presentation Global examination Presential Duration: 00:00



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				Delivery of exercise 2 Group work Global examination Not Presential Duration: 00:00
17				

Depending on the programme study plan, total values will be calculated according to the ECTS credit unit as 26/27 hours of student face-to-face contact and independent study time.



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6. Activities and assessment criteria

6.1. Assessment activities

6.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
2	Personas evaluation	Other assessment	Face-to-face	00:10	1%	/ 10	CE13
2	Individual presentation of personas	Individual presentation	Face-to-face	00:20	1%	/ 10	CE13
4	Individual presentation of principles of Design for All	Individual presentation	Face-to-face	00:30	2%	/ 10	CE13
4	Design for All evaluation	Other assessment	Face-to-face	00:10	1%	/ 10	CE13
5	Test 1	Written test	No Presential	00:30	10%	/ 10	CG13
5	Standard overview evaluation	Other assessment	Face-to-face	00:15	1%	/ 10	CE13
6	One accessibility standard evaluation (discussion)	Individual presentation	Face-to-face	00:30	5%	/ 10	CE14
7	One accessibility standard evaluation (discussion)	Individual presentation	Face-to-face	00:30	5%	/ 10	CE14
7	Delivery of exercise 1	Group work	No Presential	00:00	10%	/ 10	CG13
8	Conformity assesment evaluation	Other assessment	Face-to-face	00:15	1%	/ 10	CE14
9	Delivery of exercise 2	Group work	No Presential	00:00	15%	/ 10	CG13
9	State of the art in ICT accessibility evaluation	Other assessment	Face-to-face	00:10	1%	/ 10	CE13 CE14 CG13
10	Participation in evaluation of exercise 2	Individual presentation	Face-to-face	02:00	5%	/ 10	CE14
11	Cognitive accessibility evaluation	Other assessment	Face-to-face	00:15	1%	/ 10	CG13
12	Cognitive accessibility evaluation	Other assessment	Face-to-face	00:15	1%	/ 10	CG13
14	Delivery of exercise 4	Group presentation	No Presential	00:00	10%	/ 10	CG13



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14	Presentation of exercise 3	Group presentation	Face-to-face	02:00	5%	/ 10	CE13 CE14 CG13
15	Presentation of exercise 3	Group presentation	Face-to-face	02:00	5%	/ 10	CE13 CE14 CG13
16	Test 2	Written test	No Presential	00:30	10%	/ 10	CE14 CG13
16	Delivery of exercise 3	Group work	No Presential	00:00	10%	/ 10	CG13

6.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
6	One accessibility standard evaluation (discussion)	Individual presentation	Face-to-face	00:30	5%	/ 10	CE14
7	One accessibility standard evaluation (discussion)	Individual presentation	Face-to-face	00:30	5%	/ 10	CE14
14	Presentation of exercise 3	Group presentation	Face-to-face	02:00	5%	/ 10	CE13 CE14 CG13
15	Presentation of exercise 3	Group presentation	Face-to-face	02:00	5%	/ 10	CE13 CE14 CG13
16	Test 1	Written test	No Presential	00:30	10%	/ 10	CE13
16	Test 2	Written test	No Presential	00:30	10%	/ 10	CE14 CG13
16	Delivery of exercise 1	Group work	No Presential	00:00	10%	/ 10	CE14
16	Delivery of exercise 3	Group work	No Presential	00:00	15%	/ 10	CE13 CE14 CG13
16	Delivery of exercise 4	Group presentation	Face-to-face	00:00	15%	/ 10	CG13
16	Delivery of exercise 2	Group work	No Presential	00:00	20%	/ 10	CE14

6.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Test 1	Written test	Face-to-face	00:30	10%	/ 10	CE13
Test 2	Written test	Face-to-face	00:30	10%	/ 10	CE14 CG13
Delivery of exercise 1	Individual work	Face-to-face	00:00	15%	/ 10	CG13
Delivery of exercise 2	Individual work	Face-to-face	00:00	20%	/ 10	CG13



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Delivery of exercise 3	Individual work	Face-to-face	00:00	20%	/ 10	CE13 CE14 CG13
Presentation of exercise 3	Individual presentation	Face-to-face	02:00	10%	/ 10	CE13 CE14 CG13
Delivery of exercise 4	Individual work	Face-to-face	00:00	15%	/ 10	CG13

6.2. Assessment criteria

The assessment of this module is divided into two parts: theory and practice. Both parts have to be passed in order to pass the module. The grades obtained in theory and practice are combined as described in the section on evaluation activities.

Theory

The theoretical part of the module contains different assessments: there will be two test-based assessments and there is going to be an assessment of the performance of the collaborative learning sessions that will be part of the study of accessibility standards ("One accessibility standard evaluation", that is not recoverable); there will be also short in-class evaluations during the semester (the grading shown here is approximate, as not all students will be able to participate in all progressive assessment activities).

Practical work

The practical work consists of 4 exercises:

- Exercise 1: a document containing change proposals for an accessibility standard.
- Exercise 2: an accessibility assessment of an ICT product, using the standard studied during collaborative learning.
- Exercise 3: state of the art on one topic related to ICT accessibility. Students will make a short presentation (divided into two sessions) and deliver a report.
- Exercise 4: checking cognitive accessibility

Assessment procedure

The module will be assessed in a scale of 10 points, divided into theory and practical exercises. To pass the complete module it will be necessary to obtain a minimum of 3/10 point in theory and 3/10 points in the exercises.

a) Term evaluation



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All the practical exercises are mandatory and will be graded according to the section on evaluation activities.

In addition, attendance, class participation and in-class activities will be graded for term evaluation.

b) Final evaluation

At the end of the term, there is the final evaluation. There will be two theory exams (the first one can be done by students having failed the first one). The four exercises have to be delivered in the same time period as the one defined for term evaluation, but they could be delivered again if not passed. The student will also have to attend the two collaborative sessions ("One accessibility standard evaluation") described that are not recoverable in the final evaluation. The exercise 3 presentations cannot be recoverables.

c) Extraordinary evaluation period

In the extraordinary evaluation period the theory tests not passed will be repeated and the pending exercises can be delivered again.

7. Teaching resources

7.1. Teaching resources for the subject

Name	Type	Notes
Don't make me think!: Revisited. A Common Sense Approach to Web Usability. 2014	Bibliography	Krug, S. New Riders, 3rd edition ISBN: 978-0321965516
The Principles of Universal Design. 1997	Bibliography	Connell, B.R.; Jones, M.; Mace, R.; Mueller, J.; Mullick, A.; Ostroff, E.; Sanford, J.; Steinfeld, E.; Story, M.; Vanderheiden, G. Version 2.0. North Carolina State University. https://design.ncsu.edu/research/center-for-universal-design/

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Information technology -- User interface accessibility -- Part 1: User accessibility needs. 2018	Bibliography	International Organization for Standardization (ISO), International Electrotechnical Commission (IEC). ISO/IEC 29138-1:2018. (Technical report ISO/IEC TR 29138-1, can be accessed at http://jtc1access.org/TR29138.htm)
El modelo de la diversidad. La Bioética y los Derechos Humanos como herramientas para alcanzar la plena dignidad en la diversidad funcional. 2007	Bibliography	Palacios, A.; Romañach, J. Ediciones Diversitas, ISBN: 8496474402,
A Web for Everyone. Designing accessible user experiences. 2014	Bibliography	Horton, S.; Quesenbery, W. Rosenfeld
SIDAR	Web resource	Fundación Sidar - Acceso Universal: http://www.sidar.org , España
Accessibility Requirements for ICT products and services. V3.2.1. March 2021	Bibliography	EN 301 549. https://www.etsi.org/deliver/etsi_en/301500_301599/301549/03.02.01_60/en_301549v030201p.pdf

8. Other information

8.1. Other information about the subject

Exercises cannot be done just copying from other sources. Personal writing and analysis work by the student should be included (not third party or automatically generated reports are allowed). Failing to do this, implies plagiarism, which is not allowed at this University and will lead to not passing the exercise involved (grade will be 0).

Sustainable development goals (SDGs)

The goal of this course is to learn about enabling access of persons with disabilities to ICT, increasing their inclusion possibilities. Taking this into account, and considering the recommendations from the United Nations on

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the relationship between the SDGs and accessibility, this course is related to the following sustainable development goals:

- Goal 4 quality education - to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. In today's education, interactive learning systems are essential, and they need to be accessible and to be compatible with assistive products to enable the education of persons with disabilities.
- Goal 8 decent work and economy growth - to promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all. Today there are many job-related activities that rely on information and communication technology. This technology needs to be accessible and compatible with assistive products to enable inclusion in the workplace.
- Goal 10 reduced inequalities - to reduce inequality within and among countries. To increase inclusion of all persons in society, all interactive systems designed for citizen participation need to be accessible and be compatible with assistive products.

8.4.4 Computer Security



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SUBJECT

103000738 - Computer Security

DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

ACADEMIC YEAR & SEMESTER

2025/26 - Semester 1

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1. Description

1.1. Subject details

Name of the subject	103000738 - Computer Security
No of credits	4 ECTS
Type	Optional/elective
Academic year of the programme	First year
Semester of tuition	Semester 1
Tuition period	September-January
Tuition languages	English
Degree programme	10AM - Master Universitario en Ingeniería del Software
Centre	10 - E.T.S. De Ingenieros Informáticos
Academic year	2025-26

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Manuel Carro Liñares (Subject coordinator)	2303	manuel.carro@upm.es	M - 13:00 - 15:00 Tu - 13:00 - 15:00 W - 13:00 - 15:00 Please send an e-mail to set up an appointment before going to the instructor's office to make sure that I do not have another commitment at that



			time.
Julio Mariño Carballo	D-2308	julio.marino@upm.es	Tu - 15:00 - 17:00 W - 10:00 - 12:00 W - 15:00 - 17:00 Please get in touch with the instructor to get an appointment in order to check his availability.

* The tutoring schedule is indicative and subject to possible changes. Please check tutoring times with the faculty member in charge.

2.3. External faculty

Name and surname	Email	Institution
Juan Caballero	Juan.caballero@imdea.org	IMDEA Software Institute
Srdjan Matic	srdjan.matic@imdea.org	IMDEA Software Institute
Alessandra Gorla	alessandra.gorla@imdea.org	IMDEA Software Institute

3. Prior knowledge recommended to take the subject

3.1. Recommended (passed) subjects

The subject - recommended (passed), are not defined.

3.2. Other recommended learning outcomes

- An undergraduate level course on computer security is desired but not required. Some demonstrable knowledge on the basic principles of computer security is necessary.



4. Skills and learning outcomes *

4.1. Skills to be learned

CE13 - Tener una visión de los distintos aspectos específicos y emergentes de la ingeniería del software, y profundizar en algunos de ellos

CE14 - Comprender lo que pueden y no pueden conseguir las prácticas actuales de ingeniería del software, y sus limitaciones y su posible futura evolución.

CG1 - Que los estudiantes sepan aplicar los conocimientos adquiridos y su capacidad de resolución de problemas en entornos nuevos o poco conocidos dentro de contextos más amplios (o multidisciplinares) relacionados con su área de estudio (RD)

CG13 - Apreciación de los límites del conocimiento actual y de la aplicación práctica de la tecnología más reciente

CG14 - Conocimiento y comprensión de la informática necesaria para la creación de modelos de información, y de los sistemas y procesos complejos

CG3 - Que los estudiantes sepan comunicar sus conclusiones y los conocimientos y razones últimas que las sustentan a públicos especializados y no especializados de un modo claro y sin ambigüedades (RD)

CG7 E - Especificación y realización de tareas informáticas complejas, poco definidas o no familiares

CG8 - Planteamiento y resolución de problemas también en áreas nuevas y emergentes de su disciplina

CG9 - Aplicación de los métodos de resolución de problemas más recientes o innovadores y que puedan implicar el uso de otras disciplinas



4.2. Learning outcomes

RA80 - Identify computer security threats and decide the best proactive and reactive measures against them

* The Learning Guides should reflect the Skills and Learning Outcomes in the same way as indicated in the Degree Verification Memory. For this reason, they have not been translated into English and appear in Spanish.

5. Brief description of the subject and syllabus

5.1. Brief description of the subject

This course will focus on providing the students with a global view of the field of computer security. Classes will be divided in 2 independent blocks of lectures. Each block provides basic concepts in a core area of computer security and will comprise lectures to provide the student with basic concepts and a homework to practice and demonstrate the learned concepts.

Introduction to Security

This module will first cover a general introduction to computer security (what is security, why it is important, what areas of computer science does it draw on, etc.).

Module 1: Network Security

Then, it will introduce basic concepts of network security covering topics such as HTTPS/TLS/SSL, network scanning, and denial-of-service protection.

Module 2: Software Security

Whether you want to understand if your code is vulnerable to possible exploits or rather you want to understand if some third party code is malicious, you have to **analyze** a software artifact. This module will present different static and dynamic analysis techniques that can give a better understanding of a software artifact. Some of the techniques that we will see include symbolic execution, taint analysis, and fuzz testing. We will see that these techniques can be used for different purposes and can work for different platforms (e.g., desktop, Web, mobile).



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5.2. Syllabus

1. Introduction to Security
2. Network and web security
3. Software security



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6. Schedule

6.1. Subject schedule*

Week	Type 1 activities	Type 2 activities	Distant / On-line	Assessment activities
1	Introduction to Security Duration: 02:00 Lecture			
2	Network and web security Duration: 02:00 Lecture			
3	Network and web security Duration: 02:00 Lecture			
4	Network and web security Duration: 02:00 Lecture			
5	Network and web security Duration: 02:00 Lecture			
6	Network and web security Duration: 02:00 Lecture			
7	Network and web security Duration: 02:00 Lecture			
8	Network and web security Duration: 02:00 Lecture			
9	Midterm exam Duration: 02:00 Additional activities			Midterm exam Written test Progressive assessment Presential Duration: 02:00
10	Software security Duration: 02:00 Lecture			
11	Software security Duration: 02:00 Lecture			
12	Software security Duration: 02:00 Lecture			
13	Software security Duration: 02:00 Lecture			



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14	Software security Duration: 02:00 Lecture			
15	Software security Duration: 02:00 Lecture			
16				
17				Second partial exam Written test Progressive assessment Presential Duration: 02:00 Global exam Written test Global examination Presential Duration: 02:00

Depending on the programme study plan, total values will be calculated according to the ECTS credit unit as 26/27 hours of student face-to-face contact and independent study time.



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7. Activities and assessment criteria

7.1. Assessment activities

7.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
9	Midterm exam	Written test	Face-to-face	02:00	50%	2 / 10	CG7 E CG9 CG13 CG14 CE14 CG3 CG1 CG8 CE13
17	Second partial exam	Written test	Face-to-face	02:00	50%	2 / 10	CG7 E CG9 CG13 CG14 CE14 CG3 CG1 CG8 CE13

7.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
17	Global exam	Written test	Face-to-face	02:00	100%	5 / 10	CG9 CG13 CG14 CE14 CG3 CG1 CG8 CE13 CG7 E



7.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Comprehensive exam	Written test	Face-to-face	02:00	100%	5 / 10	CG7 E CG9 CG13 CG14 CE14 CG3 CG1 CG8 CE13

7.2. Assessment criteria

- No mandatory activities are necessary to pass via the global exam.
- The minimum grade to pass the course is 5 over 10 (either when it is calculated as the weighted sum of individual homework or when it is the grade of a single comprehensive exam).
- The midterm and global exams, both regular and extraordinary, will be made in person.
- Copying from any source (either textbooks, the Internet, another student, or any other source) with or without the permission of the author of the source, as well as other types of academic fraud, can lead to a 'fail' grade in the course and / or being reported to the academic authorities, who will decide whether to take additional authoritative measures. In particular, in case of non-ethical or fraudulent behavior, the Law 3/2022 of February 24th will be applied, as well as the corresponding UPM regulations. Article 12 and 14 of Law 3/2022 states that a serious fault may mean, among other outcomes, failing the corresponding sitting.
- There are no learning blocks whose earned grades can be carried over to future academic courses.
- Failure to deliver the homework at the time and in the form stated by the instructor(s) may result in a failure for that exercise.
- Active participation in the course can be taken into account to fine-tune the student's final grade.
- The evaluation will be based on two exams: mid-term and final.
- The mid-term exam will cover the first two modules.
- The final exam will have two parts: one of them will cover the first two modules and the other one will cover the last two modules.
- Students wishing to pass the course using progressive evaluation should make the mid-term and the part of the final exam covering the last two modules, and their grade will be calculated as 50% from the mid-term



and 50% from the part of the final exam covering the last two modules.

- Students wishing to pass the course using global evaluation, regardless of whether they made the mid-term, should make the two parts of the final exam and their grade will be calculated with 50% from the part covering the first two modules and 50% from the part covering the last two modules, regardless of whether the student made the mid-term exam.
- Any student that submits any answer (even partial) from the part of the final exam covering the two first modules will be considered to have switched to global evaluation.
- The July (resit) evaluation will consist of a single global exam covering all the material given during the course.

8. Teaching resources

8.1. Teaching resources for the subject

Name	Type	Notes
Various	Others	Will be decided based on the selected topics.

9. Other information

9.1. Other information about the subject

Additionally, optional laboratory assignments may be offered for students that want to improve their grades. Students will be notified at the course start if such lab assignments are offered.

8.4.5 Correctness by Construction



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SUBJECT

103000657 - Correctness By Construction

DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

ACADEMIC YEAR & SEMESTER

2025/26 - Semester 2



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1. Description

1.1. Subject details

Name of the subject	103000657 - Correctness By Construction
No of credits	6 ECTS
Type	Optional/elective
Academic year of the programme	First year
Semester of tuition	Semester 2
Tuition period	February-June
Tuition languages	English
Degree programme	10AM - Master Universitario en Ingeniería del Software
Centre	10 - E.T.S. De Ingenieros Informáticos
Academic year	2025-26

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Manuel Carro Liñares (Subject coordinator)	2303	manuel.carro@upm.es	M - 13:00 - 15:00 Tu - 13:00 - 15:00 W - 13:00 - 15:00 Please note that the office hours may change during the course. Please get in touch with the instructor to get an appointment.



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Manuel De Hermenegildo Salinas	2212	manuel.hermenegildo@upm.es	Sin horario. Please get in touch with the instructor to get an appointment.
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* The tutoring schedule is indicative and subject to possible changes. Please check tutoring times with the faculty member in charge.

3. Prior knowledge recommended to take the subject

3.1. Recommended (passed) subjects

The subject - recommended (passed), are not defined.

3.2. Other recommended learning outcomes

- Declarative programming
- First-order logic
- Programming experience (minimum 2 years)
- Formal proofs
- Reasoning about properties of algorithms
- Concurrent programming and concurrent systems



4. Skills and learning outcomes *

4.1. Skills to be learned

CE13 - Tener una visión de los distintos aspectos específicos y emergentes de la ingeniería del software, y profundizar en algunos de ellos

CE14 - Comprender lo que pueden y no pueden conseguir las prácticas actuales de ingeniería del software, y sus limitaciones y su posible futura evolución.

CG13 - Apreciación de los límites del conocimiento actual y de la aplicación práctica de la tecnología más reciente

4.2. Learning outcomes

RA66 - RA-AV-2 Acquaintance with various techniques for formal software development

RA25 - Communication skills in public SC13, SC14, CG3, CG18 S

RA50 - Posee las técnicas necesarias para la realización de un informe o memoria sobre un trabajo realizado en un entorno socio?lingüístico nacional/internacional.

RA69 - RA-AV-4 - Knowledge of techniques for formally proving code correctness.

RA65 - RA-AV-1 - Acquaintance with design requirements and implementation requirements.

RA54 - Proponer una solución justificada a un problema real que sea complejo o mal definido, o perteneciente a un área nueva o emergente, o que requiera el desarrollo de enfoques o métodos nuevos y originales, dentro del contexto de la ingeniería del software justificándola de una forma cualitativa y cuantitativa.

RA26 - Group work skill SC13, SC14, CG17 A

RA68 - RA-AV-3 - Knowledge of languages for formal specification

RA91 - Apply techniques for modelling the context of use

* The Learning Guides should reflect the Skills and Learning Outcomes in the same way as indicated in the Degree Verification Memory. For this reason, they have not been translated into English and appear in Spanish.

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5. Brief description of the subject and syllabus

5.1. Brief description of the subject

Software is becoming increasingly complex and responsible for critical tasks. Any technology aimed at ensuring the reliability and quality of software will be increasingly relevant, if not utterly necessary.

Only rigorous (e.g., mathematically sound) approaches can certify software with the highest possible assurance. These approaches include, among others, the use of specification languages, high-level programming languages (including equational, functional, and logic languages), the use of model checking and deductive verification, language-based approaches often interacting with theorem provers.

In this course we will give a hands-on introduction to rigorous software development methods that follow a *correctness-by-construction* approach. While the course is not heavy in theory, everyone is expected to have a good understanding of first-order logic and programming experience.



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5.2. Syllabus

1. Introduction to Formal Methods: Proving Programs Correct
2. Fundamentals of Formal Methods: Specification, First-Order Logic, Proofs, Programs
3. Event-B Basics and the Rodin Tool
4. Sequential Systems
5. Event B: Mathematical Toolkit and Applications
6. Reactive Systems: Concurrency and Distribution



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6. Schedule

6.1. Subject schedule*

Week	Type 1 activities	Type 2 activities	Distant / On-line	Assessment activities
1	Introduction to formal methods and correctness by construction Duration: 01:30 Lecture Sample cases of formal development Duration: 01:30 Cooperative activities			
2	Event-B and related topics Duration: 02:00 Lecture Quizzes Duration: 01:00 Problem-solving class			
3	Event-B and related topics Duration: 02:00 Lecture Quizzes Duration: 01:00 Problem-solving class			Homework Individual work Progressive assessment Not Presential Duration: 04:00
4	Event-B and related topics Duration: 02:00 Lecture Quizzes Duration: 01:00 Problem-solving class			
5	Event-B and related topics Duration: 02:00 Lecture Quizzes Duration: 01:00 Problem-solving class			
6	Event-B and related topics Duration: 02:00 Lecture Quizzes Duration: 01:00 Problem-solving class			Homework Individual work Progressive assessment Not Presential Duration: 04:00



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7	Event-B and related topics Duration: 02:00 Lecture Quizzes Duration: 01:00 Problem-solving class			
8	Event-B and related topics Duration: 02:00 Lecture Quizzes Duration: 01:00 Problem-solving class			
9	Event-B and related topics Duration: 02:00 Lecture Quizzes Duration: 01:00 Problem-solving class			Homework Individual work Progressive assessment Not Presential Duration: 08:00
10	Quizzes Duration: 01:00 Problem-solving class Event-B and related topics Duration: 02:00 Lecture			
11	Presentation of term project Duration: 01:00 Additional activities Event-B and related topics Duration: 02:00 Lecture			Term project Group work Progressive assessment Not Presential Duration: 20:00
12	Event-B and related topics Duration: 02:00 Lecture Quizzes Duration: 01:00 Problem-solving class			
13	Event-B and related topics Duration: 02:00 Lecture Quizzes Duration: 01:00 Problem-solving class			
14	Event-B and related topics Duration: 02:00 Lecture Quizzes Duration: 01:00 Problem-solving class			



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15	Presentaciones de trabajo en grupo Duration: 03:00 Additional activities			Presentation and defense of group projects Group presentation Progressive assessment Presential Duration: 03:00
16				
17				Final regular exam Written test Global examination Presential Duration: 03:00

Depending on the programme study plan, total values will be calculated according to the ECTS credit unit as 26/27 hours of student face-to-face contact and independent study time.



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7. Activities and assessment criteria

7.1. Assessment activities

7.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
3	Homework	Individual work	No Presential	04:00	20%	2 / 10	CE13 CE14 CG13
6	Homework	Individual work	No Presential	04:00	20%	2 / 10	CE13 CE14 CG13
9	Homework	Individual work	No Presential	08:00	20%	2 / 10	CE13 CE14 CG13
11	Term project	Group work	No Presential	20:00	%	4 / 10	CE13 CE14 CG13
15	Presentation and defense of group projects	Group presentation	Face-to-face	03:00	40%	4 / 10	CE13 CE14 CG13

7.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
17	Final regular exam	Written test	Face-to-face	03:00	100%	5 / 10	CE13 CE14 CG13

7.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Extra final exam	Written test	Face-to-face	03:00	100%	5 / 10	CE13 CE14 CG13



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7.2. Assessment criteria

- No mandatory activities are necessary to pass via the final exams
- The minimum grade to pass the course is 5 over 10 (either when it is calculated as the weighted sum of individual homework or when it is the grade of a single comprehensive exam).
- The topics covered in the different homework assignments cannot be tested separately in the final exam, as they are deeply intertwined and are not isolated units of knowledge.
- The global exams, both the regular and the extraordinary ones, will be in person.
- Copying from any source (either textbooks, the Internet, another student, or any other source) with or without the permission of the author of the source, as well as other types of academic fraud, can lead to a 'fail' grade in the course and / or being reported to the academic authorities, who will decide whether to take additional authoritative measures. In particular, in case of non-ethical or fraudulent behavior, the Law 3/2022 of February 24th will be applied, as well as the corresponding UPM regulations. Article 12 and 14 of Law 3/2022 states that a serious fault may mean, among other outcomes, failing the corresponding sitting.
- There are no learning blocks whose earned grades can be carried over to future academic courses.
- Failure to deliver a homework assignment at the time and in the form stated by the instructor(s) may result in a failure for that exercise.
- For progressive evaluation: if for any reason it is not possible to prepare / hand out some homework assignment, its weight in the final grade will be split among the rest of the homework exercises in such a way that the relative weight of the rest of the assignments, when compared with each other, will be the same they had before removing the homework that could not be handed out.

8. Teaching resources

8.1. Teaching resources for the subject

Name	Type	Notes
Lawrence Paulson's class notes	Bibliography	Lawrence Paulson's Logic and Proof are the course notes of the author for a Logic course in Cambridge. Highly recommended, as they are both rigorous and very concise. They provide very good background material for both parts of the course.



Logic in Computer Science (Huth and Ryan)	Bibliography	A very good book on the use of logic in computer science is Logic in Computer Science, by Huth and Ryan. The Computer Science School should have several copies. There may be electronic copies on the Internet, if possible of the second edition.
http://wiki.event-b.org/	Web resource	Central Event-B site
Modeling in Event-B: System and Software Engineering, by Jean-Raymond Abrial.	Bibliography	The reference book for Event B, with plenty of worked examples.

9. Other information

9.1. Other information about the subject

This course will be given in English. Please note that in case Spanish appears as the course language in the general description, that would be a clerical mistake.

8.4.6 Data Engineering



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SUBJECT

103000541 - Data Mining

DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

ACADEMIC YEAR & SEMESTER

2025/26 - Semester 1



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1. Description

1.1. Subject details

Name of the subject	103000541 - Data Mining
No of credits	4 ECTS
Type	Optional/elective
Academic year of the programme	First year
Semester of tuition	Semester 1
Tuition period	September-January
Tuition languages	English
Degree programme	10AM - Master Universitario en Ingeniería del Software
Centre	10 - E.T.S. De Ingenieros Informáticos
Academic year	2025-26

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Fco.javier Segovia Perez (Subject coordinator)	2305	javier.segovia@upm.es	M - 10:00 - 11:00 Hablar con el profesor
Ernestina Menasalvas Ruiz	4303	ernestina.menasalvas@upm.es	M - 10:00 - 11:00 hablar con la profesora

* The tutoring schedule is indicative and subject to possible changes. Please check tutoring times with the faculty member in charge.



3. Prior knowledge recommended to take the subject

3.1. Recommended (passed) subjects

The subject - recommended (passed), are not defined.

3.2. Other recommended learning outcomes

- Artificial Intelligence
- Statistics

4. Skills and learning outcomes *

4.1. Skills to be learned

CG14 - Conocimiento y comprensión de la informática necesaria para la creación de modelos de información, y de los sistemas y procesos complejos

CG18 - Capacidad de trabajar y comunicarse también en contextos internacionales

CG3 - Que los estudiantes sepan comunicar sus conclusiones y los conocimientos y razones últimas que las sustentan a públicos especializados y no especializados de un modo claro y sin ambigüedades (RD)

CG8 - Planteamiento y resolución de problemas también en áreas nuevas y emergentes de su disciplina

CG9 - Aplicación de los métodos de resolución de problemas más recientes o innovadores y que puedan implicar el uso de otras disciplinas



4.2. Learning outcomes

RA105 - Turn a business question into a data question, and use what is learned from applying a data mining process to make smart decisions that help the company or institution succeed.

RA106 - Obtain data mining results from descriptive, diagnostic, predictive, and prescriptive analysis by applying a broad and varied repertoire of classification, regression, association, segmentation, and clustering algorithms.

* The Learning Guides should reflect the Skills and Learning Outcomes in the same way as indicated in the Degree Verification Memory. For this reason, they have not been translated into English and appear in Spanish.

5. Brief description of the subject and syllabus

5.1. Brief description of the subject

At the end of this course we will make you able to:

- Turn a business question into a data question, and use what is learned from applying a data mining process to make smart decisions that help the company or institution succeed.
- Obtain data mining results from descriptive, diagnostic, predictive, and prescriptive analysis by applying a broad and varied repertoire of classification, regression, association, segmentation, and clustering algorithms.

We will use a professional data mining tool called IBM SPSS Modeler, which is designed to be user-friendly and does not require any prior programming experience.

You will learn how to use this tool by following an IBM tutorial, along with interactive class exercises and assignments.

This course is very hands-on and practical?you will mainly learn by doing. Through real examples and guided practice, you'll gain the skills needed to analyze data effectively.

By the end of the course, you will be able to solve a real-world problem of your choice using data mining techniques. Throughout the course, we will go through all the key phases of data analysis, step by step, while



practicing with real-life examples.

5.2. Syllabus

1. INTRODUCTION TO DATA ANALYSIS AND THE IBM SPSS MODELER
2. BUSINESS VALUE PROPOSITION & DATA MINING
3. DESCRIPTIVE ANALYSIS USING BASIC STATISTICS
4. DESCRIPTIVE ANALYSIS: DATA VISUALIZATION
5. DESCRIPTIVE ANALYSIS: RFM
6. DESCRIPTIVE ANALYSIS: CLUSTERING
7. DIAGNOSTIC ANALYSIS: CORRELATION, ANOVA AND CHI-SQUARED TESTS
8. DIAGNOSTIC ANALYSIS: ASSOCIATION RULES
9. PREDICTIVE ANALYSIS: LINEAR REGRESSION
10. PREDICTIVE ANALYSIS: LOGISTIC REGRESSION
11. PREDICTIVE ANALYSIS: DECISION TREES
12. PREDICTIVE ANALYSIS: NEAREST NEIGHBOR
13. PREDICTIVE ANALYSIS: NEURAL NETWORKS
14. PREDICTIVE ANALYSIS: PROBABILISTIC MODELS
15. PREDICTIVE ANALYSIS: ENSEMBLE METHODS
16. PREDICTIVE ANALYSIS: DEALING WITH TIME
17. PRESCRIPTIVE ANALYSIS: TARGETING CUSTOMERS
18. PRESCRIPTIVE ANALYSIS: RECOMMENDATION SYSTEMS
19. FINAL PROJECT



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6. Schedule

6.1. Subject schedule*

Week	Type 1 activities	Type 2 activities	Distant / On-line	Assessment activities
1	Introduction to the Data Mining Duration: 00:30 Lecture Tool practice Duration: 01:30 Problem-solving class			Tool practice Individual presentation Progressive assessment Presential Duration: 01:30
2	Exercise about Value Proposition Canvas Duration: 00:30 Problem-solving class Problem about Data Analysis on a Business Case Duration: 00:30 Problem-solving class Tool practice Duration: 01:00 Problem-solving class			Theoretical Problem Individual presentation Progressive assessment Presential Duration: 01:00 Tool practice Individual presentation Progressive assessment Presential Duration: 01:00
3	Problem about STATISTICAL DESCRIPTION using the tool Duration: 02:00 Problem-solving class			Practical Problem using the tool Individual presentation Progressive assessment Presential Duration: 02:00
4	Problem about DATA VISUALIZATION using the tool Duration: 02:00 Problem-solving class			Practical Problem using the tool Individual presentation Progressive assessment Presential Duration: 01:00
5	Problem about RFM using the tool Duration: 02:00 Problem-solving class			Practical Problem using the tool Individual presentation Progressive assessment Presential Duration: 02:00
6	Problem about CLUSTERING using the tool Duration: 02:00 Problem-solving class			Practical Problem using the tool Individual presentation Progressive assessment Presential Duration: 02:00
7	Problem about CORRELATION, ANOVA AND CHI-SQUARED TESTS using the tool Duration: 02:00 Problem-solving class			Practical Problem using the tool Individual presentation Progressive assessment Presential Duration: 02:00



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8	Problem about ASSOCIATION RULES using the tool Duration: 02:00 Problem-solving class			Practical Problem using the tool Individual presentation Progressive assessment Presential Duration: 02:00
9	Problem about LINEAR REGRESSION using the tool Duration: 02:00 Problem-solving class			Practical Problem using the tool Individual presentation Progressive assessment Presential Duration: 02:00
10	Problem about LOGISTIC REGRESSION using the tool Duration: 02:00 Problem-solving class			Practical Problem using the tool Individual presentation Progressive assessment Presential Duration: 02:00
11	Problem about DECISION TREES using the tool Duration: 02:00 Problem-solving class			Practical Problem using the tool Individual presentation Progressive assessment Presential Duration: 02:00
12	Problem about NEAREST NEIGHBOR AND NEURAL NETWORKS USING THE TOOL Duration: 02:00 Problem-solving class			Practical Problem using the tool Individual presentation Progressive assessment Presential Duration: 02:00
13	Problem about ENSEMBLE METHODS using the tool Duration: 02:00 Problem-solving class			Practical Problem using the tool Individual presentation Progressive assessment Presential Duration: 02:00
14	Problem about TIME RELATED CASES using the tool Duration: 02:00 Problem-solving class			Practical Problem using the tool Individual presentation Progressive assessment Presential Duration: 02:00
15	Problem about PRESCRIPTIVE ANALYSIS using the tool Duration: 02:00 Problem-solving class			Practical Problem using the tool Individual presentation Progressive assessment Presential Duration: 02:00
16				
17	FINAL PROJECT PRESENTATION Duration: 00:20 Additional activities			FINAL PROJECT presentation and all assignments uploaded Individual presentation Progressive assessment Presential Duration: 00:20 FINAL PROJECT presentation and all assignments uploaded Individual presentation Global examination Presential Duration: 00:20

Depending on the programme study plan, total values will be calculated according to the ECTS credit unit as 26/27 hours of student face-to-face contact and independent study time.



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7. Activities and assessment criteria

7.1. Assessment activities

7.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
1	Tool practice	Individual presentation	Face-to-face	01:30	1%	5 / 10	CG14
2	Theoretical Problem	Individual presentation	Face-to-face	01:00	1%	5 / 10	CG8 CG9 CG18 CG3
2	Tool practice	Individual presentation	Face-to-face	01:00	1%	5 / 10	CG14
3	Practical Problem using the tool	Individual presentation	Face-to-face	02:00	1%	5 / 10	
4	Practical Problem using the tool	Individual presentation	Face-to-face	01:00	1%	5 / 10	
5	Practical Problem using the tool	Individual presentation	Face-to-face	02:00	1%	5 / 10	
6	Practical Problem using the tool	Individual presentation	Face-to-face	02:00	1%	5 / 10	
7	Practical Problem using the tool	Individual presentation	Face-to-face	02:00	1%	5 / 10	
8	Practical Problem using the tool	Individual presentation	Face-to-face	02:00	1%	5 / 10	
9	Practical Problem using the tool	Individual presentation	Face-to-face	02:00	1%	5 / 10	
10	Practical Problem using the tool	Individual presentation	Face-to-face	02:00	1%	5 / 10	
11	Practical Problem using the tool	Individual presentation	Face-to-face	02:00	1%	5 / 10	
12	Practical Problem using the tool	Individual presentation	Face-to-face	02:00	1%	5 / 10	
13	Practical Problem using the tool	Individual presentation	Face-to-face	02:00	1%	5 / 10	
14	Practical Problem using the tool	Individual presentation	Face-to-face	02:00	1%	5 / 10	CG8 CG9 CG14 CG18 CG3



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15	Practical Problem using the tool	Individual presentation	Face-to-face	02:00	1%	5 / 10	CG8 CG9 CG14 CG18 CG3
17	FINAL PROJECT presentation and all assignments uploaded	Individual presentation	Face-to-face	00:20	84%	5 / 10	CG8 CG9 CG14 CG18 CG3

7.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
17	FINAL PROJECT presentation and all assignments uploaded	Individual presentation	Face-to-face	00:20	100%	5 / 10	CG8 CG9 CG14 CG18 CG3

7.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
FINAL PROJECT presentation and all assignments uploaded	Individual presentation	Face-to-face	00:20	100%	5 / 10	CG8 CG9 CG14 CG18 CG3



7.2. Assessment criteria

Course Evaluation Overview:

- In every session, we will work on a problem or assignment in class. Your final grade is based on the assignments from each session, and mainly, your final project.
- Important: You must complete, upload, and pass (minimum grade of 5 out of 10) all assignments to pass the course.

Types of Evaluation

1. Continuous (Progressive) Evaluation

You can resubmit each assignment once if needed.

2. Global Evaluation

You can only submit each assignment once. No resubmissions allowed.

3. Extraordinary Evaluation

You may resubmit only the assignments you failed during the continuous or global evaluations.



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8. Teaching resources

8.1. Teaching resources for the subject

Name	Type	Notes
Principles of Data Mining (Adaptive Computation and Machine Learning), D Hand, MIT Press, 2001.	Bibliography	
Jiawei Han, Micheline Kamber, Data Mining : Concepts and Techniques, 2nd edition, Morgan Kaufmann, ISBN 1558609016, 2006.	Bibliography	
Data Mining Techniques: Marketing, Sales and Customer Support, Michael J. A. Berry, Gordon Linoff, John Wiley & Sons, 1997.	Bibliography	
Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Introduction to Data Mining, Pearson Addison Wesley (May, 2005). Hardcover: 769 pages. ISBN: 0321321367	Bibliography	MOST RECOMMENDED BOOK
Ian Witten, Eibe Frank, Mark Hall, Data Mining: Practical Machine Learning Tools and Techniques, 3rd Edition, Morgan Kaufmann, ISBN 978-0-12-374856-0, 2011.	Bibliography	
Página web de la asignatura en moodle	Web resource	
IBM SPSS MODELER	Others	THE TOOL WE WILL USE
aula	Equipment	



9. Other information

9.1. Other information about the subject

Several innovative teaching methodologies are implemented in the course (<https://innovacioneducativa.upm.es/guias-pdi>) with the aim of motivating and reinforcing student learning:

? Learning by Doing: I use this technique, first, to help students learn how to use the IBM SPSS Modeler data mining tool. They follow a tutorial at home to learn the basics, and I continue with my own tutorial during some class sessions. Second, instead of just reading about data mining or doing exercises on paper, in each class session?after I give a theoretical introduction to a concept or technique?students use IBM SPSS Modeler to analyze real data and solve problems related to that concept or algorithm.

? Project based Learning: A large part of the students' final grade comes from completing a data mining project of their choice. Around the middle of the course, students must find a dataset related to a real-world problem that interests them and begin applying a data mining process to solve it, with a final report submitted at the end. I supervise and monitor their progress, answering questions and guiding them when they encounter difficulties. Projects can be of any type. The only requirement I impose is that students must first inform me about the dataset they want to use and the type of problem they aim to solve with it. I then check whether the dataset contains enough information and data to make the project feasible. If I determine that the dataset lacks the necessary information to successfully apply data mining techniques and algorithms, I ask them to choose a different problem and/or dataset.

8.4.7 Software Engineering for Deep Learning



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SUBJECT

103001022 - Software Engineering For Deep Learning

DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

ACADEMIC YEAR & SEMESTER

2025/26 - Semester 1



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1. Description

1.1. Subject details

Name of the subject	103001022 - Software Engineering For Deep Learning
No of credits	4 ECTS
Type	Optional/elective
Academic year of the programme	First year
Semester of tuition	Semester 1
Tuition period	September-January
Tuition languages	English
Degree programme	10AM - Master Universitario en Ingeniería del Software
Centre	10 - E.T.S. De Ingenieros Informáticos
Academic year	2025-26

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Maria Pilar Rodriguez Gonzalez	6203	pilar.rodriguez@upm.es	W - 14:00 - 17:00 F - 12:00 - 15:00
Sira Vegas Hernandez (Subject coordinator)	5105	sira.vegas@upm.es	M - 12:00 - 15:00 Th - 12:00 - 15:00

* The tutoring schedule is indicative and subject to possible changes. Please check tutoring times with the faculty member in charge.

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3. Prior knowledge recommended to take the subject

3.1. Recommended (passed) subjects

The subject - recommended (passed), are not defined.

3.2. Other recommended learning outcomes

- Basic knowledge of machine learning (recommended)
- Basic knowledge of software engineering (essential)
- Python programming language (essential)

4. Skills and learning outcomes *

4.1. Skills to be learned

CE13 - Tener una visión de los distintos aspectos específicos y emergentes de la ingeniería del software, y profundizar en algunos de ellos

CE14 - Comprender lo que pueden y no pueden conseguir las prácticas actuales de ingeniería del software, y sus limitaciones y su posible futura evolución.

CG1 - Que los estudiantes sepan aplicar los conocimientos adquiridos y su capacidad de resolución de problemas en entornos nuevos o poco conocidos dentro de contextos más amplios (o multidisciplinares) relacionados con su área de estudio (RD)

CG13 - Apreciación de los límites del conocimiento actual y de la aplicación práctica de la tecnología más reciente

CG14 - Conocimiento y comprensión de la informática necesaria para la creación de modelos de información, y de los sistemas y procesos complejos



CG18 - Capacidad de trabajar y comunicarse también en contextos internacionales

4.2. Learning outcomes

RA1 - Within an application field of Software Engineering, uses and designs the appropriate solution to solve some of its problems, describing the technical difficulties and the application limits

RA23 - Time organization capability SC13, SC14 K

RA25 - Communication skills in public SC13, SC14, CG3, CG18 S

RA84 - Being able to reframe a business question as a data question, reasoning about what data might be of assistance and how to obtain it

RA54 - Proponer una solución justificada a un problema real que sea complejo o mal definido, o perteneciente a un área nueva o emergente, o que requiera el desarrollo de enfoques o métodos nuevos y originales, dentro del contexto de la ingeniería del software justificándola de una forma cualitativa y cuantitativa.

RA56 - Materializar la solución propuesta a un problema dado en términos de código, prototipo, informes, pruebas de concepto, análisis, diseños y/o documentación, ubicándola en un entorno empresarial real.

RA18 - Given a real problem, the student chooses the most appropriate software engineering solution, analyzing the solution feasibility, what can and cannot be achieved through the current status of the chosen solution, and what it can advance in the future.

RA19 - The student explains what are the software engineering limits and frontiers, and the base for new trends and developments, and about the advanced issues and their application.

RA26 - Group work skill SC13, SC14, CG17 A

* The Learning Guides should reflect the Skills and Learning Outcomes in the same way as indicated in the Degree Verification Memory. For this reason, they have not been translated into English and appear in Spanish.



5. Brief description of the subject and syllabus

5.1. Brief description of the subject

Deep learning (DL) is emerging as a powerful approach to address very complex problems, including those faced by software engineers. It is now being explored, for example, to automatically document code, automate test generation, and even provide code patches. Yet, the DNNs being developed and their validation are at their infancy, suffering from many limitations that we do not quite understand, which may impact future research and their adoption in practice.

This course aims at understanding how DL can be incorporated to the development of software systems, and in which types of tasks it can be used.

5.2. Syllabus

1. Introduction to Deep Learning
 - 1.1. What is DL?
 - 1.2. Basics of DL
 - 1.3. Training Deep Feedforward Networks
 - 1.4. Neural Networks Architectures
2. Deep Learning for Software Engineering
 - 2.1. SE Problems that Use DL
 - 2.2. DL Architectures Used to Solve SE Problems
 - 2.3. Integrating DL into SE
3. Software Engineering for Deep Learning
 - 3.1. Developing a DL System
 - 3.2. SE Challenges of DL
 - 3.3. Incorporating SE practices to DL



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6. Schedule

6.1. Subject schedule*

Week	Type 1 activities	Type 2 activities	Distant / On-line	Assessment activities
1	Chapter 1: Description of the course and assignment Duration: 02:00 Lecture			
2	Chapter 1: Introduction to DL Duration: 02:00 Lecture			
3	Chapter 1: Introduction to DL Duration: 02:00 Laboratory assignments			
4	Chapter 1: Introduction to DL Duration: 02:00 Laboratory assignments			
5	Chapter 2: SE for DL Duration: 02:00 Lecture			
6	Chapter 2: SE for DL Duration: 02:00 Lecture			
7	Presentation of Assignment: Milestone 1 Duration: 02:00 Additional activities			Draft Submission of Assignment: Milestone 1 Group work Progressive assessment Not Presential Duration: 10:00 Presentation of Assignment: Milestone 1 Group presentation Progressive assessment Presential Duration: 02:00
8	Chapter 2: SE for DL Duration: 02:00 Lecture			Submission of Assignment: Milestone 1 Group work Progressive assessment Not Presential Duration: 01:00
9	Follow up of Assignment: Milestone 2 Duration: 02:00 Cooperative activities			
10	Chapter 2: SE for DL Duration: 02:00 Lecture			



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11	Presentation of Assignment: Milestone 2 Duration: 02:00 Additional activities			Draft Submission of Assignment: Milestone 2 Group work Progressive assessment Not Presential Duration: 20:00 Presentation of Assignment: Milestone 2 Group presentation Progressive assessment Presential Duration: 02:00
12	Follow up of Assignment: Milestone 3 Duration: 02:00 Cooperative activities			Submission of Assignment: Milestone 2 Group work Progressive assessment Not Presential Duration: 01:00
13	Chapter 3: DL for SE Duration: 02:00 Lecture			
14	Presentation of Assignment: Milestone 3 Duration: 02:00 Additional activities			Presentation of Assignment: Milestone 3 Group presentation Progressive assessment Presential Duration: 02:00 Draft Submission of Assignment: Milestone 3 Group work Progressive assessment Not Presential Duration: 30:00
15	Submission of Assignment: Milestone 3 Duration: 02:00 Additional activities			Submission of Assignment: Milestone 3 Group work Progressive assessment Presential Duration: 01:00
16				Attendance Individual work Progressive assessment Presential Duration: 00:00 Re-submission of Assignment (all 3 milestones) Group work Global examination Presential Duration: 60:00
17				

Depending on the programme study plan, total values will be calculated according to the ECTS credit unit as 26/27 hours of student face-to-face contact and independent study time.



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7. Activities and assessment criteria

7.1. Assessment activities

7.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
7	Draft Submission of Assignment: Milestone 1	Group work	No Presential	10:00	20%	3 / 10	CG13 CG14 CE14 CG1 CE13
7	Presentation of Assignment: Milestone 1	Group presentation	Face-to-face	02:00	5%	0 / 10	CG18
8	Submission of Assignment: Milestone 1	Group work	No Presential	01:00	20%	3 / 10	CG13 CG14 CE14 CG1 CE13
11	Draft Submission of Assignment: Milestone 2	Group work	No Presential	20:00	30%	3 / 10	CG14 CE14 CG13 CG1 CE13
11	Presentation of Assignment: Milestone 2	Group presentation	Face-to-face	02:00	5%	0 / 10	CG18
12	Submission of Assignment: Milestone 2	Group work	No Presential	01:00	30%	3 / 10	CG13 CG14 CE13 CG1 CE14
14	Presentation of Assignment: Milestone 3	Group presentation	Face-to-face	02:00	5%	0 / 10	CG18
14	Draft Submission of Assignment: Milestone 3	Group work	No Presential	30:00	30%	3 / 10	CG13 CG14 CE14 CG1 CE13
15	Submission of Assignment: Milestone 3	Group work	Face-to-face	01:00	30%	3 / 10	CG13 CG14 CE14 CG1 CE13



16	Attendance	Individual work	Face-to-face	00:00	5%	3 / 10	CG18
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7.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
16	Re-submission of Assignment (all 3 milestones)	Group work	Face-to-face	60:00	80%	5 / 10	CE13 CG1 CG13 CG14 CE14

7.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Second re-submission of Assignment (all milestones)	Group work	Face-to-face	60:00	80%	5 / 10	CG1 CG13 CG14 CE13 CE14

7.2. Assessment criteria

Progressive evaluation period:

- No examination will be made.
- Students will be evaluated using the evaluation tasks described above. Each of the 3 milestones of the assignment has two submissions associated: a draft submission (compulsory) and a consolidated submission (optional). The draft submissions will be presented in class in voluntary basis. Based on the feedback received by the students from the professor the day of the presentation, the students will have the opportunity to fix the draft version and submit a consolidated version.
- The final grade will be calculated using a weighted average as follows:
 - If there is a consolidated version of the milestone, the consolidated version will be graded.



Otherwise, the draft version will be graded.

- The weights will be computed according to the information given above.
- Presentations and attendance are non-recoverable activities, due to their nature. They formers are presentations of the submitted assignment and the latter computes the attendance to the course.

Global evaluation:

When the overall score obtained by the student in the progressive evaluation period is smaller than 5, the student will have to re-submit those milestones of the assignment that do not reach the minimum score required. It is not possible to complete milestones for which there is not a submission in the progressive evaluation period. In no case milestones that have a score equal or greater than 5 will be repeated. The score for the presentations and attendance will be taken from the progressive evaluation period (as they are non-recoverable activities).

Extraordinary evaluation:

When the overall score obtained by the student in the global evaluation period is smaller than 5, the student will have to repeat (or perform in case (s)he has not done it before) the milestones that do not reach the minimum score required. In no case milestones that have a score equal or greater than 5 will be repeated. The score for the presentations and attendance will be taken from the progressive evaluation period (as they are non-recoverable activities).



8. Teaching resources

8.1. Teaching resources for the subject

Name	Type	Notes
Deep Learning. I. Goofellow, Y. Bengio, A. Courville. The MIT Press	Bibliography	
Neural Networks and Deep Learning.C.C. Aggarwal. Springer	Bibliography	

9. Other information

9.1. Other information about the subject

En la asignatura se implementa la siguiente metodología docente innovadora (<https://innovacioneducativa.upm.es/guias-pdi>) con el fin de motivar y reforzar el aprendizaje por parte del estudiantado:

- **Aprendizaje orientado a proyectos:** La evaluación de la asignatura se realiza a través de un proyecto, que los alumnos realizarán en pequeños grupos, relativo al desarrollo de un sistema basado en aprendizaje profundo siguiendo prácticas de Ingeniería del Software.

8.4.8 E-Health: Promoting Active And Healthy Ageing



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SUBJECT

103001025 - E-health: Promoting Active And Healthy Ageing

DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

ACADEMIC YEAR & SEMESTER

2025/26 - Semester 1

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1. Description

1.1. Subject details

Name of the subject	103001025 - E-Health: Promoting Active And Healthy Ageing
No of credits	4 ECTS
Type	Optional/elective
Academic year of the programme	First year
Semester of tuition	Semester 1
Tuition period	September-January
Tuition languages	English
Degree programme	10AM - Master Universitario en Ingeniería del Software
Centre	10 - E.T.S. De Ingenieros Informáticos
Academic year	2025-26

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Cristian Moral Martos	5110	cristian.moral@upm.es	W - 10:00 - 14:00 F - 10:00 - 12:00 Please, ask for an appointment
Elena Villalba Mora (Subject coordinator)	5110	elena.villalba@upm.es	M - 10:00 - 12:00 W - 10:00 - 12:00 F - 10:00 - 12:00 Please, ask for an appointment

* The tutoring schedule is indicative and subject to possible changes. Please check tutoring times with the faculty



member in charge.

3. Prior knowledge recommended to take the subject

3.1. Recommended (passed) subjects

The subject - recommended (passed), are not defined.

3.2. Other recommended learning outcomes

- User Centred Design. User Experience basic knowledge.

4. Skills and learning outcomes *

4.1. Skills to be learned

CG1 - Que los estudiantes sepan aplicar los conocimientos adquiridos y su capacidad de resolución de problemas en entornos nuevos o poco conocidos dentro de contextos más amplios (o multidisciplinares) relacionados con su área de estudio (RD)

CG18 - Capacidad de trabajar y comunicarse también en contextos internacionales

CG8 - Planteamiento y resolución de problemas también en áreas nuevas y emergentes de su disciplina



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4.2. Learning outcomes

RA90 - Apply techniques for designing and implementing prototypes of different fidelity levels

RA93 - Evaluate the usability of prototypes

RA91 - Apply techniques for modelling the context of use

RA92 - Understand how user-centred design methods are used in non-academic environments

* The Learning Guides should reflect the Skills and Learning Outcomes in the same way as indicated in the Degree Verification Memory. For this reason, they have not been translated into English and appear in Spanish.

5. Brief description of the subject and syllabus

5.1. Brief description of the subject

The main focus of this subject is achieving an understanding of the necessary models, techniques and architectures that allow the development of interactive systems in the E-health domain. Topics to be covered include eHealth, eInclusion, co-production of health, empowerment, social innovation, social networks, serious games, and participation in society.

5.2. Syllabus

1. Active and Health Ageing
 - 1.1. Course introduction
 - 1.2. Definition and frameworks
2. Clinical perspective. Intrinsic capacity and frailty
3. Political perspective
4. Technological perspective
5. Social and personal perspective
6. Active and Healthy Ageing Project



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6. Schedule

6.1. Subject schedule*

Week	Type 1 activities	Type 2 activities	Distant / On-line	Assessment activities
1	1. Active and Healthy Ageing: 1.1 Course introduction 1.2. Definitions and frameworks Duration: 02:00 Lecture			
2	2. Clinical perspective. Duration: 02:00 Lecture			
3	6. Introduction to AHA project. 6.1 Topic choice Duration: 02:00 Design thinking			
4	3. Political perspective. Duration: 02:00 Lecture			
5	5. Technological perspective I Duration: 02:00 Lecture			Assignment of political and technological perspective Individual work Progressive assessment and Global Examination Not Presential Duration: 06:00
6	6. AHA Project. 6.1. Topic choice and planning of context of use observation Duration: 02:00 Design thinking			
7	4. Social and personal perspective Duration: 02:00 Lecture			Assessment. AHA Project: Planification of the observation of the context of use [non recoverable] Group work Progressive assessment Not Presential Duration: 02:00
8	5. Technological perspective II Duration: 02:00 Lecture			
9	6. AHA project. 6.2 Observation, analysis and specification of context of use Duration: 02:00 Design thinking			
10	6. AHA Project. Presentation of the Context of Use Duration: 02:00 Design thinking			Assessment. AHA Project: Context of use [non recoverable] Group work Progressive assessment Not Presential Duration: 08:00



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11	6. AHA Project. 6.3 Design and implementation of a prototype Duration: 02:00 Design thinking			
12	6. AHA Project. 6.3 Design of a prototype. Duration: 02:00 Design thinking			
13	6. AHA Project. 6.3. Creation of a prototype Duration: 02:00 Design thinking			Assessment. AHA Project: prototype [non recoverable] Group work Progressive assessment Not Presential Duration: 03:00
14	6. AHA project. 6.4 Evaluation of the prototype. Expert evaluation of heuristics Duration: 02:00 Design thinking			
15	6. AHA Project. 6.5 Analysis of results and reporting. Duration: 02:00 Design thinking			
16				Final Exam: Assessment: AHA project. Results [non recoverable] Group presentation Progressive assessment Presential Duration: 03:00
17				

Depending on the programme study plan, total values will be calculated according to the ECTS credit unit as 26/27 hours of student face-to-face contact and independent study time.



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7. Activities and assessment criteria

7.1. Assessment activities

7.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
5	Assignment of political and technological perspective	Individual work	No Presential	06:00	30%	5 / 10	CG18 CG1
7	Assessment. AHA Project: Planification of the observation of the context of use [non recoverable]	Group work	No Presential	02:00	10%	/ 10	CG18 CG1
10	Assessment. AHA Project: Context of use [non recoverable]	Group work	No Presential	08:00	20%	/ 10	CG18 CG1
13	Assessment. AHA Project: prototype [non recoverable]	Group work	No Presential	03:00	20%	/ 10	CG8 CG18 CG1
16	Final Exam: Assessment: AHA project. Results [non recoverable]	Group presentation	Face-to-face	03:00	20%	/ 10	CG8 CG18 CG1

7.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
5	Assignment of political and technological perspective	Individual work	No Presential	06:00	30%	5 / 10	CG18 CG1

7.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Final written exam	Written test	Face-to-face	03:00	100%	5 / 10	CG8 CG18 CG1

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7.2. Assessment criteria

Grading criteria

The projects will be evaluated during their iterative development during the course. Grading of students will be based on:

- Quality of the oral presentations (content, communication, slides)
- Quality of the intermediate and final results
- Ability to debate
- Active participation in class

Progressive evaluation system

The evaluation of this course is based on a progressive evaluation system (continuous evaluation), which grades the active participation of the student during the iterative development of an interactive project carried out in groups, following the human-centred design process. The project accounts for 70% of the final grade.

Besides, there is an individual assignment that accounts for the 30% of the final grade, that can be re-submitted in case a student fails it.

The evaluation activities and their concrete weight in the grading are described in "Continuous evaluation" ("Evaluación continua") above.

Global evaluation process

This course is based on the iterative development of an interactive system. Thus, the evaluation is a progressive one during the semester. Students unable to attend the classes can still submit the assignments in Moodle and will be evaluated at the same time as other students.

Given the iterative and incremental approach of the course, it is not possible to re-submit assignments related to the project at the end of the semester, but there are not minimal grades per assignment.

The political and technological individual assignment can be re-submitted if a student fails, accounting for 30% of the final grade.

Extraordinary evaluation



The extraordinary evaluation exists for students unable to pass the course during the semester. For that extraordinary evaluation students either must finish a concrete milestone they haven't passed (normally the last iteration; high-fidelity prototype and its evaluation, or the individual assignment), or a final exam that replace 100% of the grade.

8. Teaching resources

8.1. Teaching resources for the subject

Name	Type	Notes
Operational definition of Active and Healthy Ageing (AHA): A conceptual framework	Bibliography	Paper: Bousquet, Jean, et al. "Operational definition of Active and Healthy Ageing (AHA): A conceptual framework." The journal of nutrition, health & aging 19.9 (2015): 955-960.
Political context	Bibliography	Beard et al. (2016). The World Report on ageing and health: a policy framework for healthy ageing. Lancet 2016; 387: 2145-54
Age Friendly Cities	Bibliography	OMS. Global age-friendly cities: a guide (2017). Disponible en: http://www.who.int/ageing/publications/age_friendly_cities_guide/en/
mHealth	Bibliography	Mapping mHealth research: a decade of evolution. Fiordelli, Maddalena, Nicola Diviani, and Peter J. Schulz. Journal of medical Internet research 15.5 (2013).



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mHealth review	Bibliography	? From Personal to Mobile Healthcare: Challenges and Opportunities Villalba-Mora, Elena, Ignacio Peinado, and Leocadio Rodríguez-Mañas. (2016). Emerging Perspectives on the Mobile Content Evolution. IGI Global, 2016. 124-137.
Inspection Methods	Bibliography	Usability Inspection Methods. Edited by Jakob Nielsen and Robert L. Mack, published by John Wiley & Sons, New York, NY ISBN 0-471-01877-5. 1994
Design Guidelines of Mobile Apps for Older Adults: Systematic Review and Thematic Analysis	Bibliography	Paper by Gomez-Hernandez, M., Ferre, X., Moral, C., & Villalba-Mora, E. (2023). JMIR mHealth and uHealth, 11, e43186.

9. Other information

9.1. Other information about the subject

The objective of this course is to learn methods and technique to design interactive systems that have an adequate degree of usability and accessibility for a concrete vulnerable group: older population. Taking this into account, and the UN recommendations on SDGs, this subject deals with competencies related to the following SDGs:

- **Goal 4. Quality education - Ensure inclusive, equitable and quality education and promote lifelong learning opportunities for all.** To facilitate this objective, interactive systems designed for teaching, which are increasingly important in society, must meet usability and accessibility requirements discussed in the subject.
- **Goal 8. Decent work and economic growth** - Promote inclusive and sustainable economic growth, employment and decent work for all. Today many jobs depend on the use of interactive systems. These systems must meet usability and accessibility requirements to promote equal opportunities at work, not discriminating because of age. New solutions and challenges related to ageing will also create new opportunities.
- **Goal 10. Reduced inequalities** - To favor the inclusion of all people in society, interactive systems that are designed for all types of activities, including citizen participation, culture and leisure, must meet the usability



and accessibility requirements covered in the subject. This is of crucial importance for the older population whose requirements are usually not considered when designing interactive systems. This way we can reduce ageism.

Several **innovative teaching methodologies** are implemented in the course to motivate and reinforce student learning (<https://innovacioneducativa.upm.es/guias-pdi>):

- Methodology 1: Project-oriented learning: the subject is articulated through a group project that is carried out in a group and in which a User-Centred Design and Inclusive Design approach.
- Methodology 2: Challenge-Based Learning: the whole subject is articulated around a challenge that is widely recognised as one of today's major challenges: the ageing of the population.
- Methodology 3: Research-Based Learning: within the framework of the project, students carry out a first phase of user research to be able to analyse and specify the context of use.
- Methodology 4: Design Thinking: the project follows a User Centred Design, Inclusive Design and Design thinking approach.

In addition, students carry out an essay focusing on the geographical region where they live or where they come from in order to investigate policies related to ageing and technologies in ageing.

Note 1: please, always ask for an appointment before visiting a professor.

Note 2: please note that concrete dates for the assignments will be informed at the beginning of the course.

8.4.9 Experimental Software Engineering



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GUÍA DE APRENDIZAJE

ASIGNATURA

103000542 - Experimental Software Engineering

PLAN DE ESTUDIOS

10AM - Master Universitario En Ingenieria Del Software

CURSO ACADÉMICO Y SEMESTRE

2025/26 - Segundo semestre



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1. Datos descriptivos

1.1. Datos de la asignatura

Nombre de la asignatura	103000542 - Experimental Software Engineering
No de créditos	6 ECTS
Carácter	Optativa
Curso	Primer curso
Semestre	Segundo semestre
Período de impartición	Febrero-Junio
Idioma de impartición	Inglés/Castellano
Titulación	10AM - Master Universitario en Ingeniería del Software
Centro responsable de la titulación	10 - E.T.S. De Ingenieros Informáticos
Curso académico	2025-26

2. Profesorado

2.1. Profesorado implicado en la docencia

Nombre	Despacho	Correo electrónico	Horario de tutorías *
Natalia Juristo Juzgado	D-5104	natalia.juristo@upm.es	Sin horario.
Sira Vegas Hernandez (Coordinador/a)	D-5105	sira.vegas@upm.es	M - 14:00 - 17:00 J - 12:00 - 15:00

* Las horas de tutoría son orientativas y pueden sufrir modificaciones. Se deberá confirmar los horarios de tutorías con el profesorado.

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3. Conocimientos previos recomendados

3.1. Asignaturas previas que se recomienda haber cursado

El plan de estudios Master Universitario en Ingeniería del Software no tiene definidas asignaturas previas recomendadas para esta asignatura.

3.2. Otros conocimientos previos recomendados para cursar la asignatura

- Basic knowledge of statistics.

4. Competencias y resultados de aprendizaje

4.1. Competencias

CE13 - Tener una visión de los distintos aspectos específicos y emergentes de la ingeniería del software, y profundizar en algunos de ellos

CE14 - Comprender lo que pueden y no pueden conseguir las prácticas actuales de ingeniería del software, y sus limitaciones y su posible futura evolución.

CG1 - Que los estudiantes sepan aplicar los conocimientos adquiridos y su capacidad de resolución de problemas en entornos nuevos o poco conocidos dentro de contextos más amplios (o multidisciplinares) relacionados con su área de estudio (RD)

CG13 - Apreciación de los límites del conocimiento actual y de la aplicación práctica de la tecnología más reciente

CG14 - Conocimiento y comprensión de la informática necesaria para la creación de modelos de información, y de los sistemas y procesos complejos

CG18 - Capacidad de trabajar y comunicarse también en contextos internacionales

CG3 - Que los estudiantes sepan comunicar sus conclusiones y los conocimientos y razones últimas que las sustentan a públicos especializados y no especializados de un modo claro y sin ambigüedades (RD)

CG6 - Gestión de la información

CG7 E - Especificación y realización de tareas informáticas complejas, poco definidas o no familiares

CG8 - Planteamiento y resolución de problemas también en áreas nuevas y emergentes de su disciplina

CG9 - Aplicación de los métodos de resolución de problemas más recientes o innovadores y que puedan implicar el uso de otras disciplinas

4.2. Resultados del aprendizaje

RA13 - Given a particular software engineering field, the student will be able to design and evaluate the most adequate approach to solve some of the related problems, highlighting the technical difficulties and limits of application.

5. Descripción de la asignatura y temario

5.1. Descripción de la asignatura

Software engineering technologies are not being adequately evaluated. That is, professionals do not know for sure whether a technology is effective or not and, if so, cannot be sure how effective and applicable it is. This lack of proper evaluation undermines the ability of the industry to produce competitive quality software.

Experimental Software Engineering (ESE) is a discipline of Software Engineering that aims to produce reliable information for professionals about what technologies should be used in software development projects. ESE uses empirical studies (experiments, quasi-experiments, case studies, etc.) to evaluate the effectiveness of technologies for software development.

This course aims to train students in the basic skills necessary to apply the empirical methods. It focuses on the experiments, since they constitute the most mature and best understood type of empirical study in the field of SE.



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Students will learn how to perform, analyze, aggregate and replicate experiments (in industry and in academic settings).

5.2. Temario de la asignatura

1. Introduction to Experimental Software Engineering
 - 1.1. Basics of experimentalism
 - 1.2. The scientific method
 - 1.3. Scientific rules: cause-effect relationships
 - 1.4. Scientific immaturity of software engineering
2. Laboratory and Experiment
 - 2.1. The concept of laboratory
 - 2.2. The concept of experiment
 - 2.3. A lab for software engineering
 - 2.4. An experiment for software engineering
3. Elements of an Experiment
 - 3.1. Response variables
 - 3.2. Factors and levels
 - 3.3. Types of empirical studies
4. Designing Experiments
 - 4.1. Types of variables
 - 4.2. Types of control
 - 4.3. Validity
5. Data Analysis
 - 5.1. Basics of inferential statistics
 - 5.2. Parametric tests for independent samples
 - 5.3. Parametric tests for related samples



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5.4. Non parametric tests



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6. Cronograma

6.1. Cronograma de la asignatura *

Sem	Actividad tipo 1	Actividad tipo 2	Tele-enseñanza	Actividades de evaluación
1	Lecture: Course introduction Duración: 01:00 LM: Actividad del tipo Lección Magistral Lecture: What is empiricism Duración: 03:00 LM: Actividad del tipo Lección Magistral			
2	Lecture: What is an experiment Duración: 02:00 LM: Actividad del tipo Lección Magistral Brainstorming and group discussion of assignment 1 Duración: 02:00 OT: Otras actividades formativas / Evaluación			Discussion of assignment 1: what is an experiment PI: Técnica del tipo Presentación Individual Evaluación Progresiva Presencial Duración: 02:00
3	Quiz: What is an experiment Duración: 00:15 OT: Otras actividades formativas / Evaluación Lecture: Basic elements of an experiment Duración: 01:45 LM: Actividad del tipo Lección Magistral Brainstorming and group discussion of assignment 1 Duración: 02:00 OT: Otras actividades formativas / Evaluación			Quiz: what is an experiment EX: Técnica del tipo Examen Escrito Evaluación Progresiva Presencial Duración: 00:15 Discussion of assignment 1: basic elements of an experiment PI: Técnica del tipo Presentación Individual Evaluación Progresiva Presencial Duración: 02:00
4	Quiz: Basic elements of an experiment Duración: 00:15 OT: Otras actividades formativas / Evaluación Lecture: Design strategies Duración: 01:45 LM: Actividad del tipo Lección Magistral Brainstorming and group discussion of assignment 1 Duración: 02:00 OT: Otras actividades formativas / Evaluación			Discussion of assignment 1: design strategies 1 PI: Técnica del tipo Presentación Individual Evaluación Progresiva Presencial Duración: 02:00 Quiz: basic elements of an experiment EX: Técnica del tipo Examen Escrito Evaluación Progresiva Presencial Duración: 00:15



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5	Quiz: Design strategies 1 Duración: 00:15 OT: Otras actividades formativas / Evaluación Lecture: Design strategies Duración: 01:45 LM: Actividad del tipo Lección Magistral Brainstorming and group discussion of assignment 1 Duración: 02:00 OT: Otras actividades formativas / Evaluación			Discussion of assignment 1: design strategies 2 PI: Técnica del tipo Presentación Individual Evaluación Progresiva Presencial Duración: 02:00 Quiz: design strategies 1 EX: Técnica del tipo Examen Escrito Evaluación Progresiva Presencial Duración: 00:15
6	Quiz: Design strategies 2 Duración: 00:15 OT: Otras actividades formativas / Evaluación Lecture: With-in and between designs Duración: 01:45 LM: Actividad del tipo Lección Magistral Brainstorming and group discussion of assignment 1 Duración: 02:00 OT: Otras actividades formativas / Evaluación			Quiz: design strategies 2 EX: Técnica del tipo Examen Escrito Evaluación Progresiva Presencial Duración: 00:15 Discussion of assignment 1: with-in and between designs PI: Técnica del tipo Presentación Individual Evaluación Progresiva Presencial Duración: 02:00
7	Quiz: Whith-in and between designs Duración: 00:15 OT: Otras actividades formativas / Evaluación Lecture: Design trade-offs Duración: 01:45 LM: Actividad del tipo Lección Magistral Brainstorming and group discussion of assignment 1 Duración: 02:00 OT: Otras actividades formativas / Evaluación			Discussion of assignment 1: design trade-offs PI: Técnica del tipo Presentación Individual Evaluación Progresiva Presencial Duración: 02:00 Quiz: with-in and between designs EX: Técnica del tipo Examen Escrito Evaluación Progresiva Presencial Duración: 00:15
8	Quiz: Design trade-offs Duración: 00:15 OT: Otras actividades formativas / Evaluación Lecture: Threats to validity Duración: 01:45 LM: Actividad del tipo Lección Magistral Brainstorming and group discussion of assignment 1 Duración: 01:45 OT: Otras actividades formativas / Evaluación Quiz: Validity threats Duración: 00:15 OT: Otras actividades formativas / Evaluación			Quiz: design trade-offs EX: Técnica del tipo Examen Escrito Evaluación Progresiva Presencial Duración: 00:15 Discussion of assignment 1: validity threats PI: Técnica del tipo Presentación Individual Evaluación Progresiva Presencial Duración: 02:00 Quiz: validity threats EX: Técnica del tipo Examen Escrito Evaluación Progresiva Presencial Duración: 00:15



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9	Lecture: Introduction to data analysis Duración: 01:00 LM: Actividad del tipo Lección Magistral Lecture: Introduction to data analysis Duración: 01:00 PR: Actividad del tipo Clase de Problemas Lecture: Comparing 2 treatments Duración: 01:00 LM: Actividad del tipo Lección Magistral Lecture: Comparing 2 treatments Duración: 01:00 PR: Actividad del tipo Clase de Problemas			Submission of assignment 1 TI: Técnica del tipo Trabajo Individual Evaluación Progresiva No presencial Duración: 20:00
10	Lecture: Comparing 2 treatments Duración: 01:00 LM: Actividad del tipo Lección Magistral Lecture: Comparing 2 treatments Duración: 01:00 PR: Actividad del tipo Clase de Problemas Brainstorming and group discussion of assignment 2 Duración: 02:00 AC: Actividad del tipo Acciones Cooperativas			
11	Quiz: analysis 1 Duración: 00:15 OT: Otras actividades formativas / Evaluación Lecture: Comparing K treatments Duración: 01:45 LM: Actividad del tipo Lección Magistral Lecture: Comparing K treatments Duración: 02:00 LM: Actividad del tipo Lección Magistral			Quiz: analysis 1 EX: Técnica del tipo Examen Escrito Evaluación Progresiva Presencial Duración: 00:15
12	Lecture: Non-parametric tests Duración: 01:00 LM: Actividad del tipo Lección Magistral Lecture: Non-parametric tests Duración: 01:00 PR: Actividad del tipo Clase de Problemas Quiz: analysis 2 Duración: 00:15 OT: Otras actividades formativas / Evaluación Brainstorming and group discussion of assignment 2 Duración: 01:45 PL: Actividad del tipo Prácticas de Laboratorio			Quiz: analysis 2 EX: Técnica del tipo Examen Escrito Evaluación Progresiva Presencial Duración: 00:15



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13				
14				
15				Submission of assignment 2 TG: Técnica del tipo Trabajo en Grupo Evaluación Progresiva No presencial Duración: 10:00
16				Re-submission of assignment 1 TI: Técnica del tipo Trabajo Individual Evaluación Global No presencial Duración: 10:00 Re-submission of assignment 2 TG: Técnica del tipo Trabajo en Grupo Evaluación Global No presencial Duración: 10:00 Quiz: design EX: Técnica del tipo Examen Escrito Evaluación Global Presencial Duración: 01:00 Quiz: analysis EX: Técnica del tipo Examen Escrito Evaluación Global Presencial Duración: 01:00
17				

Para el cálculo de los valores totales, se estima que por cada crédito ECTS el alumno dedicará dependiendo del plan de estudios, entre 26 y 27 horas de trabajo presencial y no presencial.



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7. Actividades y criterios de evaluación

7.1. Actividades de evaluación de la asignatura

7.1.1. Evaluación (progresiva)

Sem.	Descripción	Modalidad	Tipo	Duración	Peso en la nota	Nota mínima	Competencias evaluadas
2	Discussion of assignment 1: what is an experiment	PI: Técnica del tipo Presentación Individual	Presencial	02:00	2.5%	0 / 10	CG13 CG14 CE14 CG7 E CG9 CG3 CG1 CG8 CG6 CG18 CE13
3	Quiz: what is an experiment	EX: Técnica del tipo Examen Escrito	Presencial	00:15	1.8%	0 / 10	CG13 CG14 CE14 CG7 E CG9 CG3 CG1 CG8 CG6 CG18 CE13
3	Discussion of assignment 1: basic elements of an experiment	PI: Técnica del tipo Presentación Individual	Presencial	02:00	2.5%	0 / 10	CG7 E CG9 CG13 CG14 CE14 CG3 CG1 CG8 CG6 CG18 CE13



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4	Discussion of assignment 1: design strategies 1	PI: Técnica del tipo Presentación Individual	Presencial	02:00	2.5%	0 / 10	CG7 E CG9 CG13 CG14 CE14 CG3 CG1 CG8 CG6 CG18 CE13
4	Quiz: basic elements of an experiment	EX: Técnica del tipo Examen Escrito	Presencial	00:15	1.8%	0 / 10	CG7 E CG9 CG13 CG14 CE14 CG3 CG1 CG8 CG6 CG18 CE13
5	Discussion of assignment 1: design strategies 2	PI: Técnica del tipo Presentación Individual	Presencial	02:00	2.5%	0 / 10	CG7 E CG9 CG13 CG14 CE14 CG3 CG1 CG8 CG6 CG18 CE13
5	Quiz: design strategies 1	EX: Técnica del tipo Examen Escrito	Presencial	00:15	1.8%	0 / 10	CG7 E CG9 CG13 CG14 CE14 CG3 CG1 CG8 CG6 CG18 CE13
6	Discussion of assignment 1: with-in and between designs	PI: Técnica del tipo Presentación Individual	Presencial	02:00	2.5%	0 / 10	CG7 E CG9 CG13 CG14 CE14 CG3 CG1 CG8 CG6



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							CG18 CE13
6	Quiz: design strategies 2	EX: Técnica del tipo Examen Escrito	Presencial	00:15	1.7%	0 / 10	CG13 CG14 CE14 CG3 CG1 CG8 CG6 CG18 CE13 CG9
7	Discussion of assignment 1: design trade-offs	PI: Técnica del tipo Presentación Individual	Presencial	02:00	2.5%	0 / 10	CG7 E CG9 CG13 CG14 CE14 CG3 CG1 CG8 CG6 CG18 CE13
7	Quiz: with-in and between designs	EX: Técnica del tipo Examen Escrito	Presencial	00:15	1.8%	0 / 10	CG9 CG13 CG14 CE14 CG3 CG1 CG8 CG6 CG18 CE13
8	Discussion of assignment 1: validity threats	PI: Técnica del tipo Presentación Individual	Presencial	02:00	2.5%	0 / 10	CG13 CG14 CE14 CG3 CG1 CG8 CG6 CG18 CE13 CG9
8	Quiz: design trade-offs	EX: Técnica del tipo Examen Escrito	Presencial	00:15	1.8%	0 / 10	CG9 CG13 CG14 CE14 CG3 CG1 CG8 CG6 CG18 CE13



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8	Quiz: validity threats	EX: Técnica del tipo Examen Escrito	Presencial	00:15	1.8%	0 / 10	CG7 E CG9 CG13 CG14 CE14 CG3 CG1 CG8 CG6 CG18 CE13
9	Submission of assignment 1	TI: Técnica del tipo Trabajo Individual	No Presencial	20:00	20%	0 / 10	CG9 CG13 CG7 E CG14 CE14 CG3 CG18 CG1 CG8 CG6 CE13
11	Quiz: analysis 1	EX: Técnica del tipo Examen Escrito	Presencial	00:15	5%	0 / 10	CG7 E CG9 CG13 CG14 CE14 CG3 CG1 CG8 CG6 CG18 CE13
12	Quiz: analysis 2	EX: Técnica del tipo Examen Escrito	Presencial	00:15	5%	0 / 10	CG7 E CG9 CG13 CG14 CE14 CG3 CG1 CG8 CG6 CG18 CE13
15	Submission of assignment 2	TG: Técnica del tipo Trabajo en Grupo	No Presencial	10:00	40%	5 / 10	CG7 E CG9 CG13 CG14 CE14 CG3 CG18 CG1 CG8



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							CG6 CE13
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7.1.2. Prueba evaluación global

Sem	Descripción	Modalidad	Tipo	Duración	Peso en la nota	Nota mínima	Competencias evaluadas
16	Re-submission of assignment 1	TI: Técnica del tipo Trabajo Individual	No Presencial	10:00	20%	5 / 10	CG7 E CG9 CG13 CG14 CE14 CG3 CG18 CG1 CG8 CG6 CE13
16	Re-submission of assignment 2	TG: Técnica del tipo Trabajo en Grupo	No Presencial	10:00	40%	5 / 10	CG7 E CG9 CG13 CG14 CE14 CG3 CG18 CG1 CG8 CG6 CE13
16	Quiz: design	EX: Técnica del tipo Examen Escrito	Presencial	01:00	12.5%	0 / 10	CG7 E CG9 CG13 CG14 CE14 CG3 CG1 CG8 CG6 CG18 CE13
16	Quiz: analysis	EX: Técnica del tipo Examen Escrito	Presencial	01:00	10%	0 / 10	CG13 CG14 CE14 CG3 CG7 E CG9 CG1 CG8 CG6 CG18 CE13



7.1.3. Evaluación convocatoria extraordinaria

Descripción	Modalidad	Tipo	Duración	Peso en la nota	Nota mínima	Competencias evaluadas
Extraordinary exam	EX: Técnica del tipo Examen Escrito	Presencial	02:00	82.5%	5 / 10	CG7 E CG9 CG13 CG14 CE14 CG3 CG18 CG1 CG8 CG6 CE13

7.2. Criterios de evaluación

Progressive evaluation period:

- The final grade will be calculated using a weighted average as shown above.
- Discussions are non-recoverable.

Global evaluation:

When the overall score obtained by the student in the progressive evaluation period is smaller than 5, the student will have to re-submit those assignments that do not reach the minimum score required and/or re-take the quizzes. It is not possible to re-submit the assignments or re-take the quizzes if there was no previous submission during the progressive evaluation period or if the quizzes have not been previously taken. In no case can assignments that have a score equal or greater than 5 be re-submitted. The score for the discussion will be taken from the progressive evaluation period.



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Extraordinary evaluation:

When the overall score obtained by the student in the global evaluation period is less than 5, the student will have to take an exam. After two submission attempts (during the progressive evaluation period and the global evaluation), if a student has not been able to pass the course, it means that the assignments-based mode is not suitable for them. Therefore, a different evaluation method should be used. the score for the discussion will be taken from the progressive evaluation period.

8. Recursos didácticos

8.1. Recursos didácticos de la asignatura

Nombre	Tipo	Observaciones
Natalia Juristo, Ana Moreno. Basics of software engineering experimentation. Kluwer 2001	Bibliografía	
Claes Wohlin et al. Experimentation in software engineering: an introduction. Kluwer 2000.	Bibliografía	
Course Moodle site	Recursos web	www.moodle.upm.es
Laboratory	Equipamiento	TBD
Room	Equipamiento	MUIS room

9. Otra información

9.1. Otra información sobre la asignatura

The course implements the following innovative teaching methodologies (<https://innovacioneducativa.upm.es/guias-pdi>) in order to motivate and reinforce student learning:

- **Project-based learning:** The course assessment for the design part includes the completion of a project related to the planning of a real experiment in the field of Software Engineering.
- **Problem-based learning:** The course assessment for the analysis part includes the completion of several problems related to the data analysis of a real experiment (but using synthetic data) in the field of Software Engineering.

8.4.10 Fundamentals of Business Administration



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ANX-PR/CL/001-01 LEARNING GUIDE

SUBJECT

103000680 - Fundamentals Of Business Administration

DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

ACADEMIC YEAR & SEMESTER

2025/26 - Semester 2



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1. Description

1.1. Subject details

Name of the subject	103000680 - Fundamentals Of Business Administration
No of credits	4 ECTS
Type	Optional/elective
Academic year of the programme	First year
Semester of tuition	Semester 2
Tuition period	February-June
Tuition languages	English
Degree programme	10AM - Master Universitario en Ingeniería del Software
Centre	10 - E.T.S. De Ingenieros Informáticos
Academic year	2025-26

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Raul Gutierrez Sanchis	5218	raul.g.sanchis@upm.es	Sin horario. Contact previously by e-mail
Jose Nicanor Franco Riquelme (Subject coordinator)	5217	j.franco.riquelme@upm.es	F - 12:00 - 17:00 Please send an e-mail to set up an appointment before going to the instructor's office.



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* The tutoring schedule is indicative and subject to possible changes. Please check tutoring times with the faculty member in charge.

3. Skills and learning outcomes *

3.1. Skills to be learned

CE13 - Tener una visión de los distintos aspectos específicos y emergentes de la ingeniería del software, y profundizar en algunos de ellos

CE14 - Comprender lo que pueden y no pueden conseguir las prácticas actuales de ingeniería del software, y sus limitaciones y su posible futura evolución.

CG1 - Que los estudiantes sepan aplicar los conocimientos adquiridos y su capacidad de resolución de problemas en entornos nuevos o poco conocidos dentro de contextos más amplios (o multidisciplinares) relacionados con su área de estudio (RD)

CG18 - Capacidad de trabajar y comunicarse también en contextos internacionales

CG8 - Planteamiento y resolución de problemas también en áreas nuevas y emergentes de su disciplina

3.2. Learning outcomes

RA73 - The students will be able to elicit and conceptualize customer and user's needs

RA25 - Communication skills in public SC13, SC14, CG3, CG18 S

RA2 - Facing a real problem, chooses an appropriate Software Engineering solution, analyzing its viability, what can and cannot be achieved from the current state of development of the selected solution, and what is expected to advance in the future

RA85 - Being able to understand how to effectively manage the analytical processes and use the results of these processes (models, clusters, etc.) as the basis for making informed, evidence-based decisions for creating value for a company

RA77 - Understands basic business principles

RA26 - Group work skill SC13, SC14, CG17 A

RA87 - Being able to translate a data insight into a business decision and action.



* The Learning Guides should reflect the Skills and Learning Outcomes in the same way as indicated in the Degree Verification Memory. For this reason, they have not been translated into English and appear in Spanish.

4. Brief description of the subject and syllabus

4.1. Brief description of the subject

The course introduces the student to the contemporary global business world, entrepreneurship, business modeling, managing people and organizations, organizational design, resources and capabilities, leadership, and managing information and financial issues. The primary objective is to give the student an understanding of basic business principles.

4.2. Syllabus

1. Global business environment
2. Entrepreneurship
3. Business strategy
4. Business modelling
5. Managing the business
6. Marketing
7. Organizational design
8. Managing human resources
9. Leading the business
10. Business model development
11. Controlling the business
12. Business ethics and communication



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5. Schedule

5.1. Subject schedule*

Week	Type 1 activities	Type 2 activities	Distant / On-line	Assessment activities
1	Course foundations and Intro Duration: 02:00 Lecture			
2	Global business environment Duration: 02:00 Lecture			
3	Entrepreneurship, managers and identity Duration: 02:00 Cooperative activities			
4	Business strategy Duration: 02:00 Lecture			
5	Business modelling and value proposition Duration: 02:00 Lecture			
6	Marketing Duration: 02:00 Lecture			
7	Planning the business Duration: 02:00 Lecture			
8	Managing the business Duration: 02:00 Lecture			
9	Oral presentations of the Business Concept Note Duration: 02:00 Additional activities			Submission and presentation: Business concept note Group presentation Progressive assessment Presential Duration: 02:00
10	Organizational design Duration: 02:00 Lecture			
11	Managing human resources Duration: 02:00 Lecture			
12	Leading the business Duration: 02:00 Lecture			



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13	Controlling the business Duration: 02:00 Lecture			
14	Business ethics and communication Duration: 02:00 Cooperative activities			
15	Oral presentations of the projects Duration: 02:00 Additional activities			Final presentation Group presentation Progressive assessment Presental Duration: 02:00 Submission of the project: Final report Group work Progressive assessment Not Presental Duration: 12:00 Attendance and participation Other assessment Progressive assessment Presental Duration: 00:00
16				
17				Re-submission of the project: Final Report Group work Global examination Not Presental Duration: 08:00 Re-presentation of the project Group presentation Global examination Presental Duration: 02:00

Depending on the programme study plan, total values will be calculated according to the ECTS credit unit as 26/27 hours of student face-to-face contact and independent study time.



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6. Activities and assessment criteria

6.1. Assessment activities

6.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
9	Submission and presentation: Business concept note	Group presentation	Face-to-face	02:00	20%	5 / 10	CE14 CG1 CG8 CG18 CE13
15	Final presentation	Group presentation	Face-to-face	02:00	25%	5 / 10	CE14 CG1 CG8 CG18 CE13
15	Submission of the project: Final report	Group work	No Presential	12:00	35%	5 / 10	CE14 CG1 CG8 CG18 CE13
15	Attendance and participation	Other assessment	Face-to-face	00:00	20%	5 / 10	CE13 CG18

6.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
17	Re-submission of the project: Final Report	Group work	No Presential	08:00	60%	5 / 10	CE14 CG1 CG8 CG18 CE13
17	Re-presentation of the project	Group presentation	Face-to-face	02:00	20%	5 / 10	CE14 CG1 CG8 CG18 CE13

6.1.3. Referred (re-sit) examination



Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Second re-submission of the project: Final Report	Group work	Face-to-face	08:00	60%	5 / 10	CE14 CG1 CG8 CG18 CE13
Second re-presentation of the project	Group presentation	Face-to-face	02:00	20%	5 / 10	CE14 CG1 CG8 CG18 CE13

6.2. Assessment criteria

Progressive evaluation:

Students will complete a group project. This project is based on developing a business plan to create a new company. Students will develop their projects through continuous work throughout the semester. All lectures will provide them with the proper grounds for their projects. Moreover, they will be presenting their business plan in the class continuously throughout the semester, and they will receive feedback from the lecture accordingly.

- A business concept note will be prepared and submitted throughout the first part of the course. An oral presentation and defense is expected as a mid-term evaluation. The grading scale to evaluate it will be from 0 to 10 and the grade will be common for the whole group.
- The final report will be developed throughout the semester and delivered as the final evaluation item. The grading scale to evaluate it will be from 0 to 10 and the grade will be common for the whole group.
- A final presentation (oral defense) is compulsory. Students will be developing their presentations throughout the semester receiving continuous feedback in the class. The presentation will be in groups, and the grade will be common for the whole group. The grading scale to evaluate it will be from 0 to 10 and the grade will be common for the whole group.
- Attendance and active participation **in all lectures will be considered to contribute to the final grade by 20%. The grading scale to evaluate it will be from 0 to 10 and the grade will be on an individual basis.**
- No examination will be made.

Global evaluation:



When the overall score obtained by the student in the progressive evaluation period is smaller than 5, the student will have to re-submit the Final Report (and/or repeat the presentation) that does not reach the minimum score required. In no case assignments/presentations that have a score equal to or greater than 5 will be repeated

Extraordinary evaluation:

When the overall score obtained by the student in the global evaluation period is smaller than 5, the student will have to repeat (or perform in case (s)he has not done it before) all evaluation tasks that do not reach the minimum score required. In no case evaluation tasks that have a score equal to or greater than 5 will be repeated.

7. Teaching resources

7.1. Teaching resources for the subject

Name	Type	Notes
Ronald Ebert, Ricky Griffin (2022) Business Essentials - 13th Edition, Pearson	Bibliography	Main book
Kevan Scholes, Patrick Regnér, Richard Whittington, Duncan Angwin, Gerry Johnson (2023) Exploring strategy: Text and cases - 13th edition, Pearson	Bibliography	
Stephen Robbins, Mary Coulter (2020) Management - 15th Edition, Pearson	Bibliography	
Economics @Intelligence Database, UPM	Web resource	

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8. Other information

8.1. Other information about the subject

In this course, and in case of any eventuality, although it will be a small group of students, every session could be moved to online teaching through Teams or Collaborate via Moodle. Uncertainty is rather high at the moment this guide is being validated, but everything has been defined to switch from unperson teaching to online sessions automatically.

The subject is related to SDGs 1, 4, 8, 9, 10 and 12.

8.4.11 Management, Relationships and Communication in Working Groups



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SUBJECT

103000544 - Management, Relationships And Communication In Wor

DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

ACADEMIC YEAR & SEMESTER

2025/26 - Semester 1



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1. Description

1.1. Subject details

Name of the subject	103000544 - Management, Relationships And Communication In Wor
No of credits	4 ECTS
Type	Optional/elective
Academic year of the programme	First year
Semester of tuition	Semester 1
Tuition period	September-January
Tuition languages	English
Degree programme	10AM - Master Universitario en Ingeniería del Software
Centre	10 - E.T.S. De Ingenieros Informáticos
Academic year	2025-26

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Santiago Eibe Garcia	D2311	santiago.eibe@upm.es	Th - 12:00 - 15:00 F - 12:00 - 15:00 To arrange an appointment it is mandatory to send an email in advance to susana.munoz@upm.es.



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Susana Muñoz Hernandez (Subject coordinator)	D2310	susana.munoz@upm.es	Th - 12:00 - 15:00 F - 12:00 - 15:00 To arrange an appointment it is mandatory to send an email in advance to susana.munoz@upm.es.
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* The tutoring schedule is indicative and subject to possible changes. Please check tutoring times with the faculty member in charge.

3. Prior knowledge recommended to take the subject

3.1. Recommended (passed) subjects

The subject - recommended (passed), are not defined.

3.2. Other recommended learning outcomes

- English knowledge to follow the class and be able to participate.

4. Skills and learning outcomes *

4.1. Skills to be learned

CE13 - Tener una visión de los distintos aspectos específicos y emergentes de la ingeniería del software, y profundizar en algunos de ellos

CG18 - Capacidad de trabajar y comunicarse también en contextos internacionales

CG3 - Que los estudiantes sepan comunicar sus conclusiones y los conocimientos y razones últimas que las sustentan a públicos especializados y no especializados de un modo claro y sin ambigüedades (RD)



4.2. Learning outcomes

RA24 - Conflict solving capability SC13, SC14, CG18 C

RA26 - Group work skill SC13, SC14, CG17 A

RA27 - Negotiation skill SC13, SC14, CG18 C

RA21 - Listening capability SC13, SC14, CG10 A

RA22 - Observing capability SC13, SC14, CG10 C

RA23 - Time organization capability SC13, SC14 K

RA25 - Communication skills in public SC13, SC14, CG3, CG18 S

* The Learning Guides should reflect the Skills and Learning Outcomes in the same way as indicated in the Degree Verification Memory. For this reason, they have not been translated into English and appear in Spanish.

5. Brief description of the subject and syllabus

5.1. Brief description of the subject

Outline

Within the sphere of business, research or development and cooperation, finishing a project successfully depends on several factors. So does efficiency and effectiveness of the project. One of the most important of these factors is the human factor. Communication and management skills, together with the relationship between workgroup members are some of the deciding elements for developing a well-done job. Social skills are a key aspect during the development of a task in an environment where the different members don't necessarily need to share the same characteristics.

Learning Goals

This course studies in depth the factors that determine the human skills for managing and administering a work group, aside from its supervision and smooth running assurance. It will emphasize the importance of communication (motivational, negotiation) and self-control processes, as well as the methods connected to the decision-making processes and team management abilities (leadership, conflict mediation, etc.).



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5.2. Syllabus

1. Introduction

- 1.1. Motivation I3
- 1.2. Topics Definition I3, I1

2. Communication Basis

- 2.1. Communication I1, I2, I4
- 2.2. Relation I1, I2, I4
- 2.3. Team Group I1, I2, I4

3. Personal Skills

- 3.1. Assertiveness I1, I2, I4
- 3.2. Negotiation I1, I2, I4
- 3.3. Conflict Solving I1, I2, I4
- 3.4. Intercultural differences management I1, I2, I4
- 3.5. Time Management I1, I2, I4
- 3.6. Body Language & Non verbal communication I1, I2, I4
- 3.7. Public Presentations I1, I2, I4
- 3.8. Meeting Management I1, I2, I4
- 3.9. Emotional Intelligence I1, I2, I4
- 3.10. Motivation I1, I2, I4
- 3.11. Coaching I1, I2, I4
- 3.12. Social Engineering I1, I2, I4
- 3.13. Creativity I1, I2, I4
- 3.14. Leadership I1, I2, I4



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6. Schedule

6.1. Subject schedule*

Week	Type 1 activities	Type 2 activities	Distant / On-line	Assessment activities
1	Section 1.1 and Section 1.2 Duration: 02:00 Lecture Individual work and group work. Duration: 01:00 Cooperative activities			Participation in class discussions Topic selection Individual presentation Progressive assessment and Global Examination Presential Duration: 02:00
2	Section 2.1 Duration: 02:00 Lecture Individual work and group work. Duration: 01:00 Cooperative activities			Participation in class discussions Topic selection Individual presentation Progressive assessment and Global Examination Presential Duration: 02:00
3	Section 2.2 Duration: 02:00 Lecture Individual work and group work. Duration: 01:00 Cooperative activities			Participation in class discussions Topic selection Individual presentation Progressive assessment and Global Examination Presential Duration: 02:00
4	Section 3.1, Section 3.6 and Section 3.7 Duration: 01:00 Lecture Individual work and group work. Duration: 01:00 Cooperative activities			Participation in class discussions Topic selection Individual presentation Progressive assessment and Global Examination Presential Duration: 02:00
5	Section 3.2, Section 3.6 and Section 3.7. Duration: 01:00 Lecture Individual work and group work. Duration: 01:00 Cooperative activities			Participation in class discussions Topic selection Individual presentation Progressive assessment and Global Examination Presential Duration: 02:00
6	Section 3.3, Section 3.6 and Section 3.7. Duration: 01:00 Lecture Individual work and group work. Duration: 01:00 Cooperative activities			Participation in class discussions Topic selection Individual presentation Progressive assessment and Global Examination Presential Duration: 02:00



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7	Section 3.4, Section 3.6 and Section 3.7. Duration: 01:00 Lecture Individual work and group work. Duration: 01:00 Cooperative activities			Participation in class discussions Topic selection Individual presentation Progressive assessment and Global Examination Presential Duration: 02:00
8	Section 3.5, Section 3.6 and Section 3.7. Duration: 01:00 Lecture Individual work and group work. Duration: 01:00 Cooperative activities			Participation in class discussions Topic selection Individual presentation Progressive assessment and Global Examination Presential Duration: 02:00
9	Section 3.8, Section 3.6 and Section 3.7. Duration: 01:00 Lecture Individual work and group work. Duration: 01:00 Cooperative activities			Participation in class discussions Topic selection Individual presentation Progressive assessment and Global Examination Presential Duration: 02:00
10	Section 3.9, Section 3.6 and Section 3.7. Duration: 01:00 Lecture Individual work and group work. Duration: 01:00 Cooperative activities			Participation in class discussions Topic selection Individual presentation Progressive assessment and Global Examination Presential Duration: 02:00
11	Section 3.10, Section 3.6 and Section 3.7. Duration: 01:00 Lecture Individual work and group work. Duration: 01:00 Cooperative activities			Participation in class discussions Topic selection Individual presentation Progressive assessment and Global Examination Presential Duration: 02:00
12	Section 3.11, Section 3.6 and Section 3.7. Duration: 01:00 Lecture Individual work and group work. Duration: 01:00 Cooperative activities			Participation in class discussions Topic selection Individual presentation Progressive assessment and Global Examination Presential Duration: 02:00
13	Section 3.12, Section 3.6 and Section 3.7. Duration: 01:00 Lecture Individual work and group work. Duration: 01:00 Cooperative activities			Participation in class discussions Topic selection Individual presentation Progressive assessment and Global Examination Presential Duration: 02:00
14	Section 3.13, Section 3.6 and Section 3.7. Duration: 01:00 Lecture Individual work and group work. Duration: 01:00 Cooperative activities			Participation in class discussions Topic selection Individual presentation Progressive assessment and Global Examination Presential Duration: 02:00



15	Evaluation of work and presentation Duration: 02:00 Additional activities			Evaluation of work and presentation. Other assessment Progressive assessment and Global Examination Presential Duration: 02:00
16				
17				

Depending on the programme study plan, total values will be calculated according to the ECTS credit unit as 26/27 hours of student face-to-face contact and independent study time.



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7. Activities and assessment criteria

7.1. Assessment activities

7.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
1	Participation in class discussions Topic selection	Individual presentation	Face-to-face	02:00	5%	0 / 10	CE13 CG18 CG3
2	Participation in class discussions Topic selection	Individual presentation	Face-to-face	02:00	5%	0 / 10	CE13 CG18 CG3
3	Participation in class discussions Topic selection	Individual presentation	Face-to-face	02:00	5%	0 / 10	CE13 CG18 CG3
4	Participation in class discussions Topic selection	Individual presentation	Face-to-face	02:00	5%	0 / 10	CE13 CG18 CG3
5	Participation in class discussions Topic selection	Individual presentation	Face-to-face	02:00	5%	0 / 10	CE13 CG18 CG3
6	Participation in class discussions Topic selection	Individual presentation	Face-to-face	02:00	5%	0 / 10	CE13 CG18 CG3
7	Participation in class discussions Topic selection	Individual presentation	Face-to-face	02:00	5%	0 / 10	CE13 CG18 CG3
8	Participation in class discussions Topic selection	Individual presentation	Face-to-face	02:00	5%	0 / 10	CE13 CG18 CG3
9	Participation in class discussions Topic selection	Individual presentation	Face-to-face	02:00	5%	0 / 10	CE13 CG18 CG3
10	Participation in class discussions Topic selection	Individual presentation	Face-to-face	02:00	5%	0 / 10	CE13 CG18 CG3
11	Participation in class discussions Topic selection	Individual presentation	Face-to-face	02:00	5%	0 / 10	CE13 CG18 CG3



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12	Participation in class discussions Topic selection	Individual presentation	Face-to-face	02:00	5%	0 / 10	CE13 CG18 CG3
13	Participation in class discussions Topic selection	Individual presentation	Face-to-face	02:00	5%	0 / 10	CE13 CG18 CG3
14	Participation in class discussions Topic selection	Individual presentation	Face-to-face	02:00	5%	0 / 10	CE13 CG18 CG3
15	Evaluation of work and presentation.	Other assessment	Face-to-face	02:00	30%	0 / 10	CE13 CG18 CG3

7.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
1	Participation in class discussions Topic selection	Individual presentation	Face-to-face	02:00	5%	0 / 10	CE13 CG18 CG3
2	Participation in class discussions Topic selection	Individual presentation	Face-to-face	02:00	5%	0 / 10	CE13 CG18 CG3
3	Participation in class discussions Topic selection	Individual presentation	Face-to-face	02:00	5%	0 / 10	CE13 CG18 CG3
4	Participation in class discussions Topic selection	Individual presentation	Face-to-face	02:00	5%	0 / 10	CE13 CG18 CG3
5	Participation in class discussions Topic selection	Individual presentation	Face-to-face	02:00	5%	0 / 10	CE13 CG18 CG3
6	Participation in class discussions Topic selection	Individual presentation	Face-to-face	02:00	5%	0 / 10	CE13 CG18 CG3
7	Participation in class discussions Topic selection	Individual presentation	Face-to-face	02:00	5%	0 / 10	CE13 CG18 CG3
8	Participation in class discussions Topic selection	Individual presentation	Face-to-face	02:00	5%	0 / 10	CE13 CG18 CG3
9	Participation in class discussions Topic selection	Individual presentation	Face-to-face	02:00	5%	0 / 10	CE13 CG18 CG3
10	Participation in class discussions Topic selection	Individual presentation	Face-to-face	02:00	5%	0 / 10	CE13 CG18 CG3



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11	Participation in class discussions Topic selection	Individual presentation	Face-to-face	02:00	5%	0 / 10	CE13 CG18 CG3
12	Participation in class discussions Topic selection	Individual presentation	Face-to-face	02:00	5%	0 / 10	CE13 CG18 CG3
13	Participation in class discussions Topic selection	Individual presentation	Face-to-face	02:00	5%	0 / 10	CE13 CG18 CG3
14	Participation in class discussions Topic selection	Individual presentation	Face-to-face	02:00	5%	0 / 10	CE13 CG18 CG3
15	Evaluation of work and presentation.	Other assessment	Face-to-face	02:00	30%	0 / 10	CE13 CG18 CG3

7.1.3. Referred (re-sit) examination

No se ha definido la evaluación extraordinaria.

7.2. Assessment criteria

The attendance to the classes (face to face or using video conference online at real time according the the sanitary authorities recommendations) to the classes is important because the mark of the course is spread on the participation of the students in all the sessions. So, the activities for the evaluation cannot be repeated or recuperated later because the participation of the whole class is needed to evaluate them. The observation of the other presentations to provide feedback to the classmates and demonstrate the assimilation of the contents of the course implies attending to the class and it is impossible to compensate with other non face to face activities for the characteristics of the course. A high number of missing classes will be enough for failing the course (observing the percentages to understand it).

The final grade will be calculated taking into account:

- the participation of the students during the classes. Specially during the discussions,
- the work in that the students should prepare related one of the topics of the course,
- the presentation in public of that work (face to face or online is needed by the sanitary circumstances) and
- the feedback to the classmates during the presentations of the rest of students.

The evaluation of the course is distributed during all the face to face classes. No possibility of alternative final examination is possible for this course because the interaction between the students is needed for the evaluation.



So extraordinary convocatory (in July) is not reasonable for this topic without having attended to the classes and if attendance is not possible for the student it is recommended not to enrol in this course subject.

8. Teaching resources

8.1. Teaching resources for the subject

Name	Type	Notes
Recommended reading	Bibliography	Recommended books and references related to the topic. Some of them listed in the course web site.
Subject web site	Web resource	http://babel.ls.fi.upm.es/~susana/teaching/Gestion/
Moodle site	Web resource	http://moodle.upm.es/titulaciones/oficiales/course/view.php?id=882
Equipment for presentations	Equipment	Beamer, speakers, blackboard.
Library	Equipment	Library for consulting reference books and papers.
Group work room	Equipment	Room for working in group.
Classroom	Equipment	Classroom for the presential classes and the presentations.



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9. Other information

9.1. Other information about the subject

The topic is related to the SDG4 and SDG9.

8.4.12 Programming of User Interfaces



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GUÍA DE APRENDIZAJE

ASIGNATURA

103000871 - Programming Of User Interfaces

PLAN DE ESTUDIOS

10AM - Master Universitario En Ingenieria Del Software

CURSO ACADÉMICO Y SEMESTRE

2025/26 - Primer semestre



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1. Datos descriptivos

1.1. Datos de la asignatura

Nombre de la asignatura	103000871 - Programming Of User Interfaces
No de créditos	6 ECTS
Carácter	Optativa
Curso	Primer curso
Semestre	Primer semestre
Período de impartición	Septiembre-Enero
Idioma de impartición	Inglés/Castellano
Titulación	10AM - Master Universitario en Ingeniería del Software
Centro responsable de la titulación	10 - E.T.S. De Ingenieros Informáticos
Curso académico	2025-26

2. Profesorado

2.1. Profesorado implicado en la docencia

Nombre	Despacho	Correo electrónico	Horario de tutorías *
Guillermo Roman Diez (Coordinador/a)	D2304	guillermo.roman@upm.es	L - 12:00 - 15:00 X - 12:00 - 15:00 Please, set up an appointment by email
Raul Alonso Calvo	D2315/5004	raul.alonso@upm.es	L - 10:00 - 13:00 X - 10:00 - 13:00 Please, set up an appointment by email

* Las horas de tutoría son orientativas y pueden sufrir modificaciones. Se deberá confirmar los horarios de tutorías con el profesorado.

3. Conocimientos previos recomendados

3.1. Asignaturas previas que se recomienda haber cursado

El plan de estudios Master Universitario en Ingeniería del Software no tiene definidas asignaturas previas recomendadas para esta asignatura.

3.2. Otros conocimientos previos recomendados para cursar la asignatura

- Programming skills, including elementary knowledge of object-oriented programming.

4. Competencias y resultados de aprendizaje

4.1. Competencias

CE4 - Aplicar los modelos de proceso de desarrollo a las características de un proyecto software

CG1 - Que los estudiantes sepan aplicar los conocimientos adquiridos y su capacidad de resolución de problemas en entornos nuevos o poco conocidos dentro de contextos más amplios (o multidisciplinares) relacionados con su área de estudio (RD)

CG4 - Que los estudiantes posean las habilidades de aprendizaje que les permitan continuar estudiando de un modo que habrá de ser en gran medida autodirigido o autónomo (RD)

CG9 - Aplicación de los métodos de resolución de problemas más recientes o innovadores y que puedan implicar el uso de otras disciplinas



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4.2. Resultados del aprendizaje

RA26 - Group work skill SC13, SC14, CG17 A

RA90 - Apply techniques for designing and implementing prototypes of different fidelity levels

RA99 - Implement basic interactive desktop applications

RA100 - Implement basic interactive web applications using different JavaScript frameworks

RA101 - Implement basic interactive android applications

5. Descripción de la asignatura y temario

5.1. Descripción de la asignatura

This course introduces the fundamentals of programming techniques for interactive systems. Students will learn how to design and implement good user interfaces, how user interface systems work and integrate with operating systems.

The course will focus on prototyping and development of simple graphical user interfaces (GUI) using rapid development tools such as graphical user interface layout editors combined with simple code to create functioning interfaces.

The course also focuses on practice in the skills needed for development of user interfaces to be deployed on desktop, on the World Wide Web, and on mobile platforms.

Concretely, students will learn to use technologies that are used for desktop, web and mobile applications:

- Basics on GUI, such as event-driven programming, or design patterns, like Model-View-Controller (MVC).
- Android framework and development, including system interaction, application states, layout generation, basic UI components.
- Web programming, learning basics of HTML, CSS, DOM, JavaScript client-side Frameworks, server-side languages, and, client-server communications .
- Multiplatform UI development

5.2. Temario de la asignatura

1. Introduction

- 1.1. Introduction to principles in software design and development processes
- 1.2. Principles of object oriented programming and design techniques for GUI

2. Programming Web Applications

- 2.1. Introduction to Web applications development
- 2.2. Web UI client-side components
- 2.3. Developing UI using Javascript Frameworks

3. Programming Mobile Applications

- 3.1. Introduction to Android architecture
- 3.2. Android UI layouts and components
- 3.3. Developing UI in Android

4. Programming Multiplatform Applications



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6. Cronograma

6.1. Cronograma de la asignatura *

Sem	Actividad tipo 1	Actividad tipo 2	Tele-enseñanza	Actividades de evaluación
1	1.1 Introduction to principles in software design and development processes Duración: 01:00 LM: Actividad del tipo Lección Magistral 1.2 Principles of object oriented programming and design techniques for GUI Duración: 01:00 LM: Actividad del tipo Lección Magistral 2.1 Introduction to Web applications development Duración: 02:00 LM: Actividad del tipo Lección Magistral			
2	2.2 Web UI client-side components Duración: 02:00 LM: Actividad del tipo Lección Magistral 4.2 Web UI client-side components Duración: 02:00 PL: Actividad del tipo Prácticas de Laboratorio			
3	2.3 Developing Web UI Duración: 02:00 LM: Actividad del tipo Lección Magistral 2.3 Developing Web UI Duración: 02:00 PL: Actividad del tipo Prácticas de Laboratorio			
4	2.3 Developing Web UI Duración: 02:00 PL: Actividad del tipo Prácticas de Laboratorio			Group assignment 1 (GA1): Implementation of a web application UI prototype TG: Técnica del tipo Trabajo en Grupo Evaluación Progresiva y Global No presencial Duración: 08:00
5	3.1 Introduction to Android architecture Duración: 02:00 LM: Actividad del tipo Lección Magistral 3.2 Android UI layouts and components Duración: 02:00 LM: Actividad del tipo Lección Magistral			



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6	3.2 Android UI layouts and components Duración: 02:00 LM: Actividad del tipo Lección Magistral 3.2 Android UI layouts and components Duración: 02:00 PL: Actividad del tipo Prácticas de Laboratorio			
7	3.3 Developing UI in Android Duración: 02:00 LM: Actividad del tipo Lección Magistral 3.2 Android UI layouts and components Duración: 02:00 PL: Actividad del tipo Prácticas de Laboratorio			
8	3.3 Developing UI in Android Duración: 02:00 PL: Actividad del tipo Prácticas de Laboratorio			Group assignment 2 (GA2): Implementation of an Android application UI prototype TG: Técnica del tipo Trabajo en Grupo Evaluación Progresiva y Global No presencial Duración: 08:00
9				
10	Development of multiplatform interfaces Duración: 02:00 LM: Actividad del tipo Lección Magistral Development of multiplatform interfaces Duración: 02:00 LM: Actividad del tipo Lección Magistral			
11	Development of multiplatform interfaces Duración: 02:00 LM: Actividad del tipo Lección Magistral Development of multiplatform interfaces Duración: 02:00 LM: Actividad del tipo Lección Magistral			
12	Development of multiplatform interfaces Duración: 02:00 LM: Actividad del tipo Lección Magistral			Group assignment 3 (GA3): Implementation of multiplatform UI prototype TG: Técnica del tipo Trabajo en Grupo Evaluación Progresiva y Global No presencial Duración: 08:00
13				
14				
15	Pupil portfolio presentations Duración: 02:00 OT: Otras actividades formativas / Evaluación			Pupil portfolio presentation PI: Técnica del tipo Presentación Individual Evaluación Progresiva y Global Presencial Duración: 03:00
16				



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17	Pupil portfolio presentations Duración: 02:00 OT: Otras actividades formativas / Evaluación			
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Para el cálculo de los valores totales, se estima que por cada crédito ECTS el alumno dedicará dependiendo del plan de estudios, entre 26 y 27 horas de trabajo presencial y no presencial.



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7. Actividades y criterios de evaluación

7.1. Actividades de evaluación de la asignatura

7.1.1. Evaluación (progresiva)

Sem.	Descripción	Modalidad	Tipo	Duración	Peso en la nota	Nota mínima	Competencias evaluadas
4	Group assignment 1 (GA1): Implementation of a web application UI prototype	TG: Técnica del tipo Trabajo en Grupo	No Presencial	08:00	35%	3 / 10	CE4 CG9 CG4 CG1
8	Group assignment 2 (GA2): Implementation of an Android application UI prototype	TG: Técnica del tipo Trabajo en Grupo	No Presencial	08:00	35%	3 / 10	CE4 CG9 CG4 CG1
12	Group assignment 3 (GA3): Implementation of multiplatform UI prototype	TG: Técnica del tipo Trabajo en Grupo	No Presencial	08:00	20%	3 / 10	CG9 CG4 CG1 CE4
15	Pupil portfolio presentation	PI: Técnica del tipo Presentación Individual	Presencial	03:00	10%	5 / 10	CE4 CG9 CG1 CG4

7.1.2. Prueba evaluación global

Sem	Descripción	Modalidad	Tipo	Duración	Peso en la nota	Nota mínima	Competencias evaluadas
4	Group assignment 1 (GA1): Implementation of a web application UI prototype	TG: Técnica del tipo Trabajo en Grupo	No Presencial	08:00	35%	3 / 10	CE4 CG9 CG4 CG1
8	Group assignment 2 (GA2): Implementation of an Android application UI prototype	TG: Técnica del tipo Trabajo en Grupo	No Presencial	08:00	35%	3 / 10	CE4 CG9 CG4 CG1
12	Group assignment 3 (GA3): Implementation of multiplatform UI prototype	TG: Técnica del tipo Trabajo en Grupo	No Presencial	08:00	20%	3 / 10	CG9 CG4 CG1 CE4



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15	Pupil portfolio presentation	PI: Técnica del tipo Presentación Individual	Presencial	03:00	10%	5 / 10	CE4 CG9 CG1 CG4
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7.1.3. Evaluación convocatoria extraordinaria

Descripción	Modalidad	Tipo	Duración	Peso en la nota	Nota mínima	Competencias evaluadas
Group assignment 1 (GA1): Implementation of a web application UI prototype	TG: Técnica del tipo Trabajo en Grupo	Presencial	08:00	35%	3 / 10	CE4 CG9 CG1 CG4
Group assignment 2 (GA2): Implementation of an Android application UI prototype	TG: Técnica del tipo Trabajo en Grupo	Presencial	08:00	35%	3 / 10	CE4 CG9 CG1 CG4
Group assignment 3 (GA3): Implementation of multiplatform UI prototype	TG: Técnica del tipo Trabajo en Grupo	Presencial	08:00	20%	3 / 10	CE4 CG9 CG1 CG4
Pupil portfolio presentation	PI: Técnica del tipo Presentación Individual	Presencial	00:30	10%	5 / 10	CE4 CG9 CG1 CG4

7.2. Criterios de evaluación

Student portfolio presentation will be held on final exam date. So, **it will not be resit in global evaluation** due to a lack of time. So, it will be retaken in referred (re-sit) examination.

Assessment projects for web UI, desktop GUI and Android UI. **They will not be retaken in global evaluation** due to:

- **Working overload for students.** Project retakes in the global evaluation, could interfere with other subjects or courses
- **Working overload for teachers.** Evaluation process takes a lot of effort. So, it is impossible to make

projects evaluations in global evaluation

So, they will be retaken in referred (re-sit) examination

Grade Criteria based on:

- Quality of pupil assignment
- Ability to understand concepts
- Capacity of presenting their work

NOTE: The groups of 3 people created to develop GA1, GA2 and GA3 cannot change along the course.

8. Recursos didácticos

8.1. Recursos didácticos de la asignatura

Nombre	Tipo	Observaciones
Moodle	Recursos web	https://moodle.upm.es/titulaciones/oficiales
Java Foundations: Introduction to Program Design and Data Structures	Bibliografía	Lewis J., DePasquale P., Chase J., 2/E, Pearson, 2010
Java SDK	Otros	
Eclipse EE	Otros	
Android SDK	Otros	
Android Studio	Otros	

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9. Otra información

9.1. Otra información sobre la asignatura

NOTE: This course has 4 hours per week, thus, the course has a duration of 12 weeks instead of 15 weeks.

Metodologías docentes innovadoras aplicadas en la asignatura:

Learning by doing: Los alumnos deben enfrentarse a lo largo de la asignatura a 3 entregas prácticas distribuidas a lo largo de las 12 semanas lectivas que dura el semestre. Estos retos prácticos tienen una temática realista y para cada una de las prácticas los alumnos reciben una serie de instrucciones y un código de apoyo para su realización.

Aprendizaje basado en retos: La metodología Learning by Doing se integra a la perfección con el aprendizaje basado en retos. Cada uno de los ejercicios prácticos que se proponen es un reto que éstos deben resolver. Al distribuir estos retos a lo largo del semestre, los estudiantes que se implican en las prácticas llevan al día los contenidos, mejorando de esta forma el seguimiento de la asignatura.

8.4.13 Strategic Management and Entrepreneurship



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ASIGNATURA

103001023 - Strategic Management & Entrepreneurship

PLAN DE ESTUDIOS

10AM - Master Universitario En Ingenieria Del Software

CURSO ACADÉMICO Y SEMESTRE

2025/26 - Segundo semestre

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1. Datos descriptivos

1.1. Datos de la asignatura

Nombre de la asignatura	103001023 - Strategic Management & Entrepreneurship
No de créditos	4 ECTS
Carácter	Optativa
Curso	Primer curso
Semestre	Segundo semestre
Período de impartición	Febrero-Junio
Idioma de impartición	Inglés/Castellano
Titulación	10AM - Master Universitario en Ingeniería del Software
Centro responsable de la titulación	10 - E.T.S. De Ingenieros Informáticos
Curso académico	2025-26

2. Profesorado

2.1. Profesorado implicado en la docencia

Nombre	Despacho	Correo electrónico	Horario de tutorías *
Claudio Antonio Feijoo Gonzalez (Coordinador/a)		claudio.feijoo@upm.es	--

* Las horas de tutoría son orientativas y pueden sufrir modificaciones. Se deberá confirmar los horarios de tutorías con el profesorado.

3. Conocimientos previos recomendados

3.1. Asignaturas previas que se recomienda haber cursado

El plan de estudios Master Universitario en Ingeniería del Software no tiene definidas asignaturas previas recomendadas para esta asignatura.

3.2. Otros conocimientos previos recomendados para cursar la asignatura

- Interest in entrepreneurship and / or innovation

4. Competencias y resultados de aprendizaje

4.1. Competencias

CE13 - Tener una visión de los distintos aspectos específicos y emergentes de la ingeniería del software, y profundizar en algunos de ellos

CG1 - Que los estudiantes sepan aplicar los conocimientos adquiridos y su capacidad de resolución de problemas en entornos nuevos o poco conocidos dentro de contextos más amplios (o multidisciplinares) relacionados con su área de estudio (RD)

CG18 - Capacidad de trabajar y comunicarse también en contextos internacionales

CG3 - Que los estudiantes sepan comunicar sus conclusiones y los conocimientos y razones últimas que las sustentan a públicos especializados y no especializados de un modo claro y sin ambigüedades (RD)

CG9 - Aplicación de los métodos de resolución de problemas más recientes o innovadores y que puedan implicar el uso de otras disciplinas



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4.2. Resultados del aprendizaje

RA25 - Communication skills in public SC13, SC14, CG3, CG18 S

RA57 - Exposición y defensa de la solución propuesta de un modo claro y sin ambigüedades ante un público especializado y no especializado.

RA97 - The student is expected to analyse, design and develop an open innovation project in a software-related company

RA26 - Group work skill SC13, SC14, CG17 A

RA95 - The student is expected to understand the basics of strategic management in a software-related company

RA94 - Students are expected to understand and be able to use a number of very practical methods to manage innovative and entrepreneurial projects and performance indicators as part of a company or organization strategy

RA98 - The student is expected to acquire practical knowledge on entrepreneurship techniques such as design thinking, value proposition and lean startup in the context of software-related company

RA22 - Observing capability SC13, SC14, CG10 C

RA21 - Listening capability SC13, SC14, CG10 A

RA23 - Time organization capability SC13, SC14 K

RA24 - Conflict solving capability SC13, SC14, CG18 C

RA27 - Negotiation skill SC13, SC14, CG18 C

RA36 - Posee dotes para liderar el cambio dentro de la organización

RA37 - Está capacitado para introducir mejoras en la organización

5. Descripción de la asignatura y temario

5.1. Descripción de la asignatura

Summary ? Course description

After completing the course, students are expected to understand and be able to use a number of very practical methods to manage innovative and entrepreneurial projects and performance indicators as part of a company or organization strategy.

This subject departs from the idea that the new methods originated in the entrepreneurial arena in the last decade can be extremely useful for managers as they allow to understand the customer better and from the start, rapidly adapting any theoretical project to realistic metrics, acknowledging the fact that innovation and business models are created in a learning process, and that innovation can be ?engineered? to increase the chances of success of any organization.

From a strategic perspective, organizations need to use new approaches to innovation and entrepreneurship to guarantee their competitive advantages in the mid to long term. Open innovation schemes or lean approaches to customers have become key elements of a renewed strategic management.

The course consists of several parts. It starts with an introduction to a revisited strategic management, including economic foundations and the increasingly relevant role of innovation and entrepreneurship. From here a number of cases and projects will be selected for the students to team work on them. All the projects will loosely follow the lean approach to innovation using methodologies such as creative thinking, value creation, ecosystem analysis, business model canvas and lean startup. It will also include practical sessions about other aspects of the strategic management with a view on (open) innovation and entrepreneurship such as the role of organizational structure, technology, communication, IPR and internationalization.

The course will emphasize the practical side of the tools and will introduce related key concepts on the innovation / entrepreneurial ecosystems with a particular focus on software-related companies.

During the course, students will team work in a practical project of their own that will be presented, discussed and evaluated in a final pitch session.

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Objectives and requirements



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This is a practical graduate-level course on tools and methodologies for strategic managers based on new developments in entrepreneurship and innovation.

There are three major objectives of this course: (i) to provide students with some conceptual and practical tools to improve their strategic management skills in particular on innovation-related projects and situations; (ii) to provide students with the general rationale and ordered logical steps when approaching innovation from a strategic management perspective; (iii) to provide hands-on knowledge on tools, methods and approaches to tap on innovation and entrepreneurship from the perspective of strategic management.

Students are recommended to enjoy practical interest in innovation and entrepreneurship. Ideally, they should have an innovation strategy for a company or organization of their own, although this is not a strict requisite since during first classes some cases will be provided for the students so they can choose.

Sessions will include work on projects to be developed and discussed during the classes. Therefore, it is highly recommendable to bring a laptop or tablet with basic applications (word processor, presentation software, spreadsheet) and Internet connection. Students are also requested to read the references assigned to each session and to provide results for the assignments.

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Programme & Schedule

NB: This is a tentative programme. The topics are indicative. Program might be modified depending on the interest of students about the subjects covered, on the level and depth of the discussion, and on the availability of the possible invited lecturers.

Session Time Subject

1 2h Introduction to the course. Presentation of students (background and motivation). Program, assignments and evaluation. Background: The increasing relevance of innovation and entrepreneurship.

2 2h What it is strategy? How to study strategy? The evolution of strategy. Economic foundations of strategy. The role of innovation and entrepreneurship in strategy

3 2h Individual work assignment

4 2h Economies of scale and scope. Sources of economies of scale and scope. Diseconomies of scale. The learning curve. Diversification.

5 2h Value network. Make vs. buy. Integration.

6 2h Innovation and Entrepreneurship ecosystem

7 2h Industry analysis. Competition and cooperation

- 8 2h The role of innovation. Types of innovation. Open innovation.
- 9 2h Idea market. Team setting and assignment
- 10 2h Entrepreneurship: concepts
- 11 2h Cases in strategic management & entrepreneurship. Design thinking
- 12 2h Strategic positioning. Competitive advantage. Value creation.
- 13 2h DNA of a project.
- 14 2h Value proposition canvas
- 15 2h Testing & experimenting. Customer development. Validated learning. Minimum viable product. Product-market fit
- 16 2h Experiment board.
- 17 2h Business and lean model canvas in a strategic setting. Tools and methodologies for high-risk, high-uncertainty environments
- 18 2h Lean startup and open innovation
- 19 2h Engaging with startups to enhance corporate innovation. Corporation entrepreneurship
- 20 2h Information and value creation
- 21 2h Sustaining competitive advantage
- 22 2h Open science, open software and open standards. User innovation
- 23 2h Preparing the pitch: How to. Pre-mortem analysis. Beyond the pitch
- 24 4h Visits / Guest lectures / webinars / online events from incubators, accelerators and open innovation initiatives
- 25 4h Workshops (pitch) for presentation and discussion of results of workgroups projects



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5.2. Temario de la asignatura

1. Introduction to the course. Presentation of students (background and motivation). Program, assignments and evaluation. Background: The increasing relevance of innovation and entrepreneurship
2. What it is strategy? How to study strategy? The evolution of strategy. Economic foundations of strategy. The role of innovation and entrepreneurship in strategy
3. Individual work assignment
4. Economies of scale and scope. Sources of economies of scale and scope. Diseconomies of scale. The learning curve. Diversification
5. Value network. Make vs. buy. Integration
6. Innovation and Entrepreneurship ecosystem
7. Industry analysis. Competition and cooperation
8. The role of innovation. Types of innovation. Open innovation
9. Idea market. Team setting and assignment
10. Entrepreneurship: concepts
11. Cases in strategic management & entrepreneurship. Design thinking
12. Strategic positioning. Competitive advantage. Value creation
13. DNA of a project
14. Value proposition canvas
15. Testing & experimenting. Customer development. Validated learning. Minimum viable product. Product-market fit
16. Experiment board
17. Business and lean model canvas in a strategic setting. Tools and methodologies for high-risk, high-uncertainty environments
18. Lean startup and open innovation
19. Engaging with startups to enhance corporate innovation. Corporation entrepreneurship
20. Information and value creation
21. Sustaining competitive advantage
22. Open science, open software and open standards. User innovation
23. Preparing the pitch: How to. Pre-mortem analysis. Beyond the pitch



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24. Visits / Guest lectures / webinars / online events from incubators, accelerators and open innovation initiatives

25. Workshops (pitch) for presentation and discussion of results of workgroups projects



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6. Cronograma

6.1. Cronograma de la asignatura *

Sem	Actividad tipo 1	Actividad tipo 2	Tele-enseñanza	Actividades de evaluación
1	Regular session in the classroom Duración: 02:00 LM: Actividad del tipo Lección Magistral			
2	Regular session in the classroom Duración: 02:00 LM: Actividad del tipo Lección Magistral			
3	Individual assignment Duración: 02:00 OT: Otras actividades formativas / Evaluación			Individual assignment TI: Técnica del tipo Trabajo Individual Evaluación Progresiva y Global Presencial Duración: 02:00
4	Regular session in the classroom Duración: 02:00 LM: Actividad del tipo Lección Magistral			
5	Regular session in the classroom Duración: 02:00 LM: Actividad del tipo Lección Magistral			
6	Regular session in the classroom Duración: 02:00 AC: Actividad del tipo Acciones Cooperativas			
7	Teamwork assignment Duración: 02:00 OT: Otras actividades formativas / Evaluación			Teamwork assignment PG: Técnica del tipo Presentación en Grupo Evaluación Progresiva y Global Presencial Duración: 02:00
8	Regular session in the classroom Duración: 02:00 AC: Actividad del tipo Acciones Cooperativas			
9	Regular session in the classroom Duración: 02:00 AC: Actividad del tipo Acciones Cooperativas			
10	Regular session in the classroom Duración: 02:00 AC: Actividad del tipo Acciones Cooperativas			
11	Regular session in the classroom Duración: 02:00 AC: Actividad del tipo Acciones Cooperativas			



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12	Regular session in the classroom Duración: 02:00 OT: Otras actividades formativas / Evaluación			
13	Regular session in the classroom Duración: 02:00 AC: Actividad del tipo Acciones Cooperativas			
14	Regular session in the classroom Duración: 01:00 AC: Actividad del tipo Acciones Cooperativas	Participation and contributions during classes Duración: 01:00 OT: Otras actividades formativas / Evaluación		Participation and contributions during classes OT: Otras técnicas evaluativas Evaluación Progresiva y Global Presencial Duración: 01:00
15	Pitch. Teamwork presentation Duración: 02:00 OT: Otras actividades formativas / Evaluación			Pitch. Teamwork presentation PG: Técnica del tipo Presentación en Grupo Evaluación Progresiva y Global Presencial Duración: 02:00
16				
17				Global evaluation is the result of adding the individual + teamwork + participation - Other students need to ask for extraordinary evaluation OT: Otras técnicas evaluativas Evaluación Global No presencial Duración: 00:00

Para el cálculo de los valores totales, se estima que por cada crédito ECTS el alumno dedicará dependiendo del plan de estudios, entre 26 y 27 horas de trabajo presencial y no presencial.



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7. Actividades y criterios de evaluación

7.1. Actividades de evaluación de la asignatura

7.1.1. Evaluación (progresiva)

Sem.	Descripción	Modalidad	Tipo	Duración	Peso en la nota	Nota mínima	Competencias evaluadas
3	Individual assignment	TI: Técnica del tipo Trabajo Individual	Presencial	02:00	40%	6 / 10	CG1 CG3 CG18 CE13 CG9
7	Teamwork assignment	PG: Técnica del tipo Presentación en Grupo	Presencial	02:00	20%	5 / 10	CG1 CG9 CG3 CG18 CE13
14	Participation and contributions during classes	OT: Otras técnicas evaluativas	Presencial	01:00	20%	0 / 10	CG1 CG18 CE13 CG3 CG9
15	Pitch. Teamwork presentation	PG: Técnica del tipo Presentación en Grupo	Presencial	02:00	20%	0 / 10	CG3 CG18 CE13 CG1 CG9

7.1.2. Prueba evaluación global

Sem	Descripción	Modalidad	Tipo	Duración	Peso en la nota	Nota mínima	Competencias evaluadas
3	Individual assignment	TI: Técnica del tipo Trabajo Individual	Presencial	02:00	40%	6 / 10	CG1 CG3 CG18 CE13 CG9
7	Teamwork assignment	PG: Técnica del tipo Presentación en Grupo	Presencial	02:00	20%	5 / 10	CG1 CG9 CG3 CG18 CE13



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14	Participation and contributions during classes	OT: Otras técnicas evaluativas	Presencial	01:00	20%	0 / 10	CG1 CG18 CE13 CG3 CG9
15	Pitch. Teamwork presentation	PG: Técnica del tipo Presentación en Grupo	Presencial	02:00	20%	0 / 10	CG3 CG18 CE13 CG1 CG9
17	Global evaluation is the result of adding the individual + teamwork + participation - Other students need to ask for extraordinary evaluation	OT: Otras técnicas evaluativas	No Presencial	00:00	%	0 / 10	CG9 CG3 CG18 CE13 CG1

7.1.3. Evaluación convocatoria extraordinaria

Descripción	Modalidad	Tipo	Duración	Peso en la nota	Nota mínima	Competencias evaluadas
Compensation work - Just for the individual assignment. Participation and Teamwork are not possible to be compensated	TI: Técnica del tipo Trabajo Individual	Presencial	02:00	60%	5 / 10	CG3 CG9 CG1 CG18 CE13



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7.2. Criterios de evaluación

Evaluation criteria

The evaluation will be based on the individual assignments and teamwork:

- ? Individual assignment / exam: 40%
- ? Teamwork (including pitch / online presentation): 40%
- ? Contributions / participation during classes: 20%

The criteria for evaluation will be:

- ? Understanding of the concepts explained
- ? Ability to apply them in an actual strategic setting
- ? Contributions to discussion
- ? Thinking outside the box

8. Recursos didácticos

8.1. Recursos didácticos de la asignatura

Nombre	Tipo	Observaciones
Lecture Notes	Recursos web	Notes for each session
[1] Economic Foundations of Strategy, Joseph T. Mahoney, Sage Publications Inc, 2005.	Bibliografía	
[2] Osterwalder, A., Pigneur, Y., & Clark, T. (2010). Business model generation: A handbook for visionaries, game changers, and challengers. Hoboken. NJ: Wiley.	Bibliografía	



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[3] Blank, S., & Dorf, B. (2012). The startup owner's manual. K&S; Ranch	Bibliografía	
[4] Ries, E. (2011). The lean startup: How today's entrepreneurs use continuous innovation to create radically successful businesses. Random House LLC.	Bibliografía	
[5] Besanko, D., Dranove, D., Shanley, M., Schaefer, S. (2017). Economics of strategy. Wiley, 7th Ed.	Bibliografía	
[6] Chesbrough, H. (2020). Open innovation results. Going beyond the hype and getting down to business. Oxford: Oxford University Press.	Bibliografía	
[7] M. Mazzucato. ?The value of everything. Making and taking in the global economy?. PublicAffairs, 2018	Bibliografía	

9. Otra información

9.1. Otra información sobre la asignatura

The subject is related to digital governance and transformation. Therefore has some connection with SDG 16 about promoting peaceful and inclusive societies, providing access to justice for all and building effective, accountable and inclusive institutions at all levels.

8.4.14 User Experience and Mobile Interaction



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SUBJECT

103000874 - User Experience And Mobile Interaction

DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

ACADEMIC YEAR & SEMESTER

2025/26 - Semester 1



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1. Description

1.1. Subject details

Name of the subject	103000874 - User Experience And Mobile Interaction
No of credits	6 ECTS
Type	Optional/elective
Academic year of the programme	First year
Semester of tuition	Semester 1
Tuition period	September-January
Tuition languages	English
Degree programme	10AM - Master Universitario en Ingeniería del Software
Centre	10 - E.T.S. De Ingenieros Informáticos
Academic year	2025-26

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Ricardo Imbert Paredes (Subject coordinator)	D-5112	ricardo.imbert@upm.es	Tu - 15:00 - 18:00 W - 15:00 - 18:00 It is advisable to confirm by email the availability of the professor
Jose Maria Barambones Ramirez	5106	j.barambones@upm.es	M - 10:00 - 12:00 Tu - 10:00 - 12:00 Th - 12:00 - 14:00 It is advisable to confirm by email the



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			availability of the professor
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* The tutoring schedule is indicative and subject to possible changes. Please check tutoring times with the faculty member in charge.

3. Prior knowledge recommended to take the subject

3.1. Recommended (passed) subjects

The subject - recommended (passed), are not defined.

3.2. Other recommended learning outcomes

- Human-Computer Interaction principles

4. Skills and learning outcomes *

4.1. Skills to be learned

CG13 - Apreciación de los límites del conocimiento actual y de la aplicación práctica de la tecnología más reciente

CG14 - Conocimiento y comprensión de la informática necesaria para la creación de modelos de información, y de los sistemas y procesos complejos



4.2. Learning outcomes

RA102 - RA102 - Understand the particularities of the user experience beyond usability, considering emotions

RA103 - RA103 - Understand the particularities of user-centered design in mobile platforms and ubiquitous computing.

RA104 - RA104 - Apply techniques and processes for prototyping, developing, and refining interactive digital systems in different technological platforms.

* The Learning Guides should reflect the Skills and Learning Outcomes in the same way as indicated in the Degree Verification Memory. For this reason, they have not been translated into English and appear in Spanish.

5. Brief description of the subject and syllabus

5.1. Brief description of the subject

This course will be focused on designing mobile interactions with good user experience (UX). Contents of the course include: UX as a broadening of the scope of usability, design concepts, global user interfaces, designing for mobile experiences, interaction design patterns for mobile applications, mobile wireframes and prototypes and platform-specific design guidelines.

5.2. Syllabus

1. Introduction to UX and mobile interaction
2. Context and specific needs related solution
3. Design of memorable experiences
4. UX & UI: Visual principles
5. UX in the product design
6. Mobile prototyping
7. Design guidelines
8. Evaluation of the UX



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6. Schedule

6.1. Subject schedule*

Week	Type 1 activities	Type 2 activities	Distant / On-line	Assessment activities
1	1. Introduction to UX&MI Duration: 03:00 Lecture			
2	2. Context and specific needs related solution Duration: 01:00 Cooperative activities Affinity diagraming activity (needs) Duration: 02:00 Cooperative activities			Affinity diagraming (needs) Group work Progressive assessment Presential Duration: 02:00
3	2. Context and specific needs related solution Duration: 01:00 Cooperative activities Value proposition canvas exercise Duration: 02:00 Cooperative activities			Value proposition canvas exercise Group work Progressive assessment Presential Duration: 02:00
4	2. Context and specific needs related solution Duration: 00:30 Lecture Personas workshop Duration: 02:30 Cooperative activities			Personas workshop Other assessment Progressive assessment Presential Duration: 02:30
5	3. Design of memorable experiences Duration: 00:30 Lecture User journey map exercise Duration: 02:30 Additional activities			User profiles, empathy map and refinement of value proposition Group work Progressive assessment Not Presential Duration: 00:00 User journey map exercise Group presentation Progressive assessment Presential Duration: 02:30
6	4. UX&UI: Visual principles Duration: 01:00 Lecture Contrast exercise Duration: 02:00 Additional activities			Contrast exercise Group work Progressive assessment Presential Duration: 02:00 Assignment about color observation Individual work Progressive assessment and Global Examination Not Presential



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				Duration: 00:00
7	4. UX&UI: Visual principles Duration: 00:15 Lecture Mood board exercise Duration: 02:45 Additional activities			Assignment about typefaces Individual work Progressive assessment and Global Examination Not Presential Duration: 00:00 Mood board exercise Group work Progressive assessment Presential Duration: 02:45
8	5. UX in the product design Duration: 03:00 Cooperative activities			
9	5. UX in the product design Duration: 00:30 Lecture Assignment about product design Duration: 02:30 Additional activities			Assignment about product design Group work Progressive assessment Presential Duration: 02:30
10	6. Mobile prototyping Duration: 03:00 Cooperative activities			
11	7. Design guidelines Duration: 00:30 Lecture Analysis of mobile apps with UX problems exercise Duration: 02:30 Cooperative activities			Analysis of mobile apps with UX problems Group work Progressive assessment and Global Examination Not Presential Duration: 00:00
12	6. Mobile prototyping Duration: 03:00 Cooperative activities			
13	8. UX evaluation Duration: 00:30 Lecture Assignment about 5 seconds test Duration: 02:30 Additional activities			Assignment about 5 seconds test Group work Progressive assessment Presential Duration: 02:30
14	8. UX evaluation Duration: 00:30 Lecture Assignment about UEQ Duration: 02:30 Additional activities			Assignment about UEQ Group work Progressive assessment Presential Duration: 02:30
15	Mobile prototype evaluation follow up Duration: 03:00 Additional activities			



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16				
17	Presentation of the prototype evaluation results Duration: 03:00 Additional activities			Mobile prototype evaluation assignment Group work Progressive assessment Not Presential Duration: 00:00 Student implication and participation Other assessment Progressive assessment Presential Duration: 00:00

Depending on the programme study plan, total values will be calculated according to the ECTS credit unit as 26/27 hours of student face-to-face contact and independent study time.



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7. Activities and assessment criteria

7.1. Assessment activities

7.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
2	Affinity diagraming (needs)	Group work	Face-to-face	02:00	1.2%	0 / 10	CG13
3	Value proposition canvas exercise	Group work	Face-to-face	02:00	3%	0 / 10	CG13 CG14
4	Personas workshop	Other assessment	Face-to-face	02:30	3%	0 / 10	CG13
5	User profiles, empathy map and refinement of value proposition	Group work	No Presential	00:00	7.2%	0 / 10	CG13 CG14
5	User journey map exercise	Group presentation	Face-to-face	02:30	7.2%	0 / 10	CG14
6	Contrast exercise	Group work	Face-to-face	02:00	7.2%	0 / 10	CG14
6	Assignment about color observation	Individual work	No Presential	00:00	7.2%	0 / 10	CG14
7	Assignment about typefaces	Individual work	No Presential	00:00	7.2%	0 / 10	CG13
7	Mood board exercise	Group work	Face-to-face	02:45	7.2%	0 / 10	CG14
9	Assignment about product design	Group work	Face-to-face	02:30	7.2%	0 / 10	CG13 CG14
11	Analysis of mobile apps with UX problems	Group work	No Presential	00:00	7.2%	0 / 10	CG13 CG14
13	Assignment about 5 seconds test	Group work	Face-to-face	02:30	7.2%	0 / 10	CG13
14	Assignment about UEQ	Group work	Face-to-face	02:30	7.2%	0 / 10	CG13
17	Mobile prototype evaluation assignment	Group work	No Presential	00:00	14.4%	0 / 10	CG13 CG14
17	Student implication and participation	Other assessment	Face-to-face	00:00	6.4%	0 / 10	CG13 CG14

7.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
6	Assignment about color observation	Individual work	No Presential	00:00	7.2%	0 / 10	CG14



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7	Assignment about typefaces	Individual work	No Presential	00:00	7.2%	0 / 10	CG13
11	Analysis of mobile apps with UX problems	Group work	No Presential	00:00	7.2%	0 / 10	CG13 CG14

7.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Mobile prototype refactoring and evaluation	Group work	Face-to-face	00:00	14.4%	0 / 10	CG13 CG14
Assignment about color observation	Individual work	Face-to-face	00:00	7.2%	0 / 10	CG14
Assignment about typefaces	Individual work	Face-to-face	00:00	7.2%	0 / 10	CG13
Assignment about 5 seconds test	Group work	Face-to-face	00:00	7.2%	0 / 10	CG13
Assignment about UEQ	Group work	Face-to-face	00:00	7.2%	0 / 10	CG13
Analysis of mobile apps with UX problems	Group work	Face-to-face	00:00	7.2%	0 / 10	CG13 CG14

7.2. Assessment criteria

Progressive evaluation

The subject is graded following a continuous assessment.

The subject's progressive evaluation consist of:

- *Individual assignments (14,4% of the final grade)*: the student must complete several individual assignments related to some specific aspects of the subject. These activities **are recoverable** in the global and extraordinary evaluation, always that they had been failed (grade below 5).
- *Group assignments (79,2% of the final grade)*: the purpose of the group assignments is to learn basic concepts and techniques by applying them to a product that will be developed by the students in an incremental and iterative way during the semester. That means that the assignments corresponding to the last steps (prototype refactoring, prototype evaluation, 5 seconds test and UEQ) are **the only recoverable ones**. Since these products are delivered the day before the final presentation, it is impossible to evaluate them in the global evaluation. Therefore, they will be only recoverable in the extraordinary evaluation. However, the group activity "Analysis of mobile apps with UX problems (7,2% of the final grade) is also recoverable in both the global and extraordinary evaluation, since it is not part of the whole project.
- *Student participation (6,4% of the final grade)*: a critical mindset and the analysis skills from the student are valued. These activities are **not recoverable**, either in the global evaluation or in the final evaluation, since



it is the student participation during the classes what it is evaluated.

The student passes the subject only if 5 or more points on 10 are obtained at the end of the course, regarding the following criteria:

FINAL GRADE = 14,4% Individual assignments + 79,2% Group assignments + 6,4% Student participation

Global evaluation

When failed during the progressive evaluation, the student may have a new opportunity to pass the subject repeating the recoverable failed parts. Since these parts cover a 21,6% of the final grade this will be the margin for passing the subject during the global evaluation.

Extraordinary evaluation

For the extraordinary term evaluation the student can repeat the following activities, only if they are graded under 5:

- The correction of the mobile HiFi prototype, taking into account the errors made and the results of the evaluation performed during the ordinary period, and its evaluation (7,2% of the final grade).
- The analysis of mobile apps with UX problems (7,2%).
- The evaluation of the HiFi prototype UX through the technique of the 5 seconds test (7,2% of the final grade).
- The evaluation of the HiFi prototype UX through the UEQ technique (7,2% of the final grade).
- The individual assignment about color observation (7,2%).
- The individual assignment about typefaces (7,2%).

Zero tolerance against fraud

If fraudulent acts are detected during the development of evaluation tests, the provisions of article 13 of the UPM Evaluation Regulations approved by the Governing Council on May 26, 2022 will apply.



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8. Teaching resources

8.1. Teaching resources for the subject

Name	Type	Notes
Norman, D. (2013) The Design of Everyday Things. Zone Books	Bibliography	UX and general design essential
Griffiths, S. (2015) Mobile App UX Principles. Improving user experience and optimising conversion. Google (https://www.thinkwithgoogle.com/intl/en-gb/articles/mobile-app-ux-principles-improving-user-experience-and-optimising-conversion.html)	Bibliography	UX in mobile design
Mendoza, A (2013) Mobile User Experience. Patterns to Make Sense of it All. Morgan Kaufmann	Bibliography	UX in mobile design
Doncaster, P. (2014) The UX Five Second Rules. Guidelines for User Experience Design's Simplest Testing Technique. Elsevier	Bibliography	UX testing
Subject's Moodle site	Web resource	https://moodle.upm.es/titulaciones/oficiales/course/view.php?id=7964
Subject MS Teams group	Web resource	Live online lectures, workshops and presentations



9. Other information

9.1. Other information about the subject

Innovative Teaching Methodologies Applied in the Course

Several innovative teaching methodologies are implemented in the course (<https://innovacioneducativa.upm.es/guias-pdi>) with the aim of motivating and reinforcing student learning:

- **Learning by Doing:** Most sessions follow a structure of 30 minutes dedicated to presenting the theory related to the session, followed by 2 hours in which students work on a problem posed by the instructor to build a solution under their supervision. The final 30 minutes are used for students to present their solutions and conclusions, which are then discussed and debated among all the students who have worked on similar problems.
- **Design Thinking:** Topic 5.1, "UX in Product Design", is structured following a Design Sprint approach?Google Ventures? methodology for solving complex problems, developing and validating solutions within a week. The underlying process is essentially similar to Design Thinking, involving cycles of divergence and convergence: identifying numerous value opportunities within the context the students are working on, selecting the most promising one, proposing multiple alternative solutions to the identified need, selecting the best one, prototyping, and evaluating.
- **Research-Based Learning:** In Topic 4.3, "Typography", after a theoretical session introducing the fundamentals of typography and its use in digital media, students are assigned a research task on a specific typeface. They must explore its characteristics, historical and contextual background, most notable uses, and potential applications in our context.
- **Collaborative Learning:** After completing their research in Topic 4.3, students participate in a workshop-style activity as supported by Moodle. Each student is randomly assigned peers? projects to review. They assess the work using a rubric provided by the instructors and give constructive feedback. Through this process, students learn about their assigned typeface, others investigated by their classmates, and develop critical and constructive perspectives on the work.
- **Project-Based Learning:** From the beginning of the course, students work in groups to propose a project topic, understood as an original, unmet need. Throughout the course, they develop their proposal through various



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stages: user research and analysis, user modeling, identification of the application's usage journey, proposal and design of a solution, implementation of high-fidelity prototypes, and evaluation of the user experience with actual users.