



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

Educational Planning Course 2022-23  
First and Second Semester

Computer Science and Engineering School  
Universidad Politécnica de Madrid



## Contenido

<b>1</b>	<b>Pre-enrollment Dates</b>	<b>1</b>
<b>2</b>	<b>Calendar</b>	<b>2</b>
<b>3</b>	<b>Schedule</b>	<b>3</b>
<b>4</b>	<b>Exam Calendar</b>	<b>5</b>
<b>5</b>	<b>Courses Coordinators</b>	<b>8</b>
<b>6</b>	<b>Courses Boards</b>	<b>9</b>
<b>7</b>	<b>Learning Guides</b>	<b>10</b>
7.1	Software Development Module . . . . .	10
7.1.1	Requirements Engineering . . . . .	10
7.1.2	Software Architecture . . . . .	24
7.1.3	Software Design . . . . .	38
7.2	Project Management and Organizational Processes Module .	50
7.2.1	Models and Methods for Process Improvement and Assessment . . . . .	50
7.2.2	Software Project Management . . . . .	66
7.3	Support Processes Module . . . . .	78
7.3.1	Software Metrics . . . . .	78
7.3.2	Verification and Validation . . . . .	90
7.3.3	Software Quality Management . . . . .	105
7.4	Advanced Software Engineering Aspects Module . . . . .	123
7.4.1	Agile Software Development: Agile Practices and Ag- ile Usability . . . . .	123
7.4.2	Challenges for Accessible Computing for People with Functional Diversity . . . . .	134
7.4.3	Critical Software . . . . .	151

7.4.4	Data Engineering . . . . .	162
7.4.5	Management, Relationships and Communication in Working Groups . . . . .	175
7.4.6	Correctness by Construction . . . . .	190
7.4.7	Computer Security . . . . .	204
7.4.8	Agent Based Software Development . . . . .	216
7.4.9	Experimental Software Engineering . . . . .	232
7.4.10	Fundamentals of Business Administration . . . . .	246
7.4.11	Adaptive Systems . . . . .	257
7.4.12	Deep Learning and Software Engineering . . . . .	272
7.4.13	E-Health: Promoting Active And Healthy Ageing . . .	284
7.4.14	Strategic Management and Entrepreneurship . . . . .	296

## 1 Pre-enrollment Dates

- **First period:** from 1 February to 30 June 2022
- **Second period:** from 14 November 2022 to 15 January 2023

First semester starts on 12 September 2022

Second semester starts on 30 January 2023

September-22						
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-22						
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-22						
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-22						
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-23						
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-23						
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-23						
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-23						
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-23						
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-23						
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-23						
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: 20 July-4 August and 5-9 September 2022



Unenrollment for 2nd Semester (max. 12 ECTS): 1-7 February 2023



Restricted extension of enrollment: 8-14 February 2023

NOTE: On Friday 4th November 2022, the classes will follow the schedule of a usual Tuesday in all courses and subjects, as a compensation for holidays  
Compensation for holidays in the Spring semester to be defined when 2023 holidays are established

## EMSE - First Semester (September-January)



	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	Computer Security		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 Engineering *					
Thursday			Deep learning and Software Engineering		Verification and Validation		Critical Software	
			Management, Relationships and Communication in Working Groups					
Friday			Agile Software Development: Agile Practices and Agile Usability		Requirements Engineering			



 Mandatory Subjects  
 Elective Subjects

 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 *		Assessment Activities	
Tuesday			Software Quality Management *		Experimental Software Engineering			
Wednesday			Agent-Based Software Engineering *	Correctness by Construction				
Thursday			Fundamentals of Business Administration *					
			Experimental Software Engineering		Agent-Based Software Engineering *			
Friday								

 Mandatory Subjects  
 Elective Subjects

 Elective Subjects (weeks 1 to 12)  
 Special Activities



## 4 Exam Calendar

### 1st and 3rd Semester (Fall Term)

JANUARY 2023							
MONDAY		TUESDAY		WEDNESDAY		THURSDAY	
16		17		18		19	
				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		Software Project Management 15:00	Agile Software Development: Agile Practices and Agile Usability 15:00
Adaptive Systems 18:00				Computer Security 18:00		Critical Software 18:00	
23		24		25		26	
Models and Methods for Process Improvement and Assessment 15:00		Deep Learning and Software Engineering 15:00		Requirements Engineering 15:00		Master Thesis 10:00	
Data Mining 18:00				Management, Relationships and Communication in Working Groups 18:00			
20		21		22		23	

2nd Semester (Spring Term)

MAY-JUNE 2023						
MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY
29	30	31	1	2	3	4
	Software Architecture 15:00	Software Quality Management 15:00	Fundamentals of Business Administration 15:00	Software Design 15:00		
5	6	7	8	9	10	11
Agent-based Software Engineering 15:00	Experimental Software Engineering 15:00	Correctness by Construction 15:00	Strategic Management and Entrepreneurship 15:00			
12	13	14	15	16	17	18
		Master Thesis 10:00				

## Extraordinary period (JUL)

JUNE-JULY 2023						
MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY
19	20	21	22	23	24	25
			Software Design 15:00	Models and Methods for Process Improvement and Assessment 15:00		
			Data Mining 18:00			
26	27	28	29	30	1	2
Verification and Validation 15:00	Agile Software Development: Agile Practices and Agile Usability 15:00	Software Metrics 15:00	Software Architecture 15:00	E-Health: Promoting Active and Healthy Aging 12:00		
Adaptive Systems 18:00	Challenges for Accessible Computing for People with Functional Diversity 18:00	Critical Software 18:00	Management, Relationships and Communication in Working Groups 18:00	Requirements Engineering 15:00		
3	4	5	6	7	8	9
Software Quality Management 15:00	Software Project Management 15:00	Fundamentals of Business Administration 15:00	Experimental Software Engineering 15:00			
Computer Security 18:00	Agent-based Software Engineering 18:00	Correctness by Construction 18:00				
10	11	12	13	14	15	16
Deep Learning and Software Engineering 15:00	Strategic Management and Entrepreneurship 15:00	Master Thesis 10:00				

## 5 Courses Coordinators

### Máster Universitario en Ingeniería de Software European Master in Software Engineering

Subjects for Course 2022/2023

MODULE SOFTWARE DEVELOPMENT				
Course unit name	Coordinator	Type	ECTS	Term
Requirements Engineering	Óscar Dieste	C	6	1, 3
Software Architecture	Jaime Ramírez	C	4	2
Software Design	Nelson Medinilla	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
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
Critical Software	Andrés Silva	E	4	1, 3
Data Engineering	Javier Segovia	E	4	1, 3
Experimental Software Engineering	Sira Vegas	E	6	2
Fundamentals of Business Administration	Ebru Susur	E	4	2
Adaptive Systems	Jaime Ramírez	E	4	1, 3
Management, Relationships and Communication in Working Groups	Susana Muñoz	E	4	1, 3
Correctness by Construction	Manuel Carro	E	6	2
Computer Security	Manuel Carro	E	4	1, 3
Agent-based Software Engineering	Ricardo Imbert	E	6	2
Deep Learning and Software Engineering	Sira Vegas	E	4	1
Strategic Management and Entrepreneurship	Claudio Feijoo	E	4	2
E-Health: Promoting Active and Healthy Aging	Elena Villalba	E	4	1

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	Sira Vegas	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 2022/2023

SUBJECT	PRESIDENT	VOCAL	SECRETARY	SUBSTITUTE
Adaptive Systems	Jaime Ramírez	Angélica de Antonio	Ricardo Imbert	Elena Villalba
Agent-based Software Engineering	Ricardo Imbert	Tomás San Feliu	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
Critical Software	Andrés Silva	Óscar Dieste	Ricardo Imbert	Jaime Ramírez
Data Engineering	Javier Segovia	Ernestina Menasalvas	Alejandro Rodríguez	Jaime Ramírez
Deep Learning and Software Engineering	Sira Vegas	Pilar Rodríguez	Óscar Dieste	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	Ebru Susur	Pilar Quevedo	Jaime Ramírez	Angélica de Antonio
Management, Relationships and Communication in Working Groups	Susana Muñoz	Julio Mariño	Lars-Åke Fredlund	Jaime Ramírez
Master Thesis	Sira Vegas	Ricardo Imbert	Pilar Rodríguez	Jaime Ramírez
Models and Methods for Process Improvement and Assessment	José A. Calvo-Manzano	Tomás San Feliu	Ricardo Imbert	Jaime Ramírez
Requirements Engineering	Óscar Dieste	Pilar Rodríguez	Sira Vegas	Jaime Ramírez
Seminars	Jaime Ramírez	Ricardo Imbert	Óscar Dieste	Angélica de Antonio
Software Architecture	Jaime Ramírez	Nelson Medinilla	Angélica de Antonio	Tomás San Feliu
Software Design	Nelson Medinilla	Sira Vegas	Ricardo Imbert	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	José A. Calvo-Manzano	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
Verification and Validation	Sira Vegas	Pilar Rodríguez	Óscar Dieste	Jaime Ramírez

## **7 Learning Guides**

### **7.1 Software Development Module**

#### **7.1.1 Requirements Engineering**



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Informaticos

# ANX-PR/CL/001-01

## LEARNING GUIDE

### SUBJECT

**103000482 - Requirements Engineering**

### DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

### ACADEMIC YEAR & SEMESTER

2022/23 - Semester 1



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## Index

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### Learning guide

1. Description.....	1
2. Faculty.....	1
3. Skills and learning outcomes .....	2
4. Brief description of the subject and syllabus.....	3
5. Schedule.....	4
6. Activities and assessment criteria.....	8
7. Teaching resources.....	11





## 1. Description

### 1.1. Subject details

<b>Name of the subject</b>	103000482 - Requirements Engineering
<b>No of credits</b>	6 ECTS
<b>Type</b>	Compulsory
<b>Academic year of the programme</b>	First year
<b>Semester of tuition</b>	Semester 1
<b>Tuition period</b>	September-January
<b>Tuition languages</b>	English
<b>Degree programme</b>	10AM - Master Universitario en Ingenieria del Software
<b>Centre</b>	10 - Escuela Tecnica Superior De Ingenieros Informaticos
<b>Academic year</b>	2022-23

## 2. Faculty

### 2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Natalia Juristo Juzgado	D5104	natalia.juristo@upm.es	Sin horario. Please check office hours in the "Course information section" at Moodle.
Oscar Dieste Tubio (Subject coordinator)	D5106	oscar.dieste@upm.es	Sin horario. Please check office hours in the "Course information section" at Moodle.



\* 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 \*

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#### 3.1. Skills to be learned

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. Learning outcomes

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

\* 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

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### 4.1. Brief description of the subject

The requirements engineering course aims to teach or expand students' abilities regarding software requirements: elicitation, analysis, documentation, validation and management. The course will balance lectures and practical activities. Special attention will be paid to tool support. Whenever possible, professional from industry will deliver keynotes about specific requirements engineering topics.

### 4.2. Syllabus

1. Requirements engineering processes
2. Requirements elicitation
3. Requirements analysis
4. Requirements documentation
5. Requirements validation
6. Requirements management/release planning



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## 5. Schedule

### 5.1. Subject schedule\*

Week	Classroom activities	Laboratory activities	Distant / On-line	Assessment activities
1	<b>Requirements engineering process (including agile approaches)</b> Duration: 00:30 Lecture  <b>Course goals and methodology</b> Duration: 00:10 Lecture  <b>Software project proposal</b> Duration: 00:10 Additional activities  <b>Term paper proposal</b> Duration: 00:10 Additional activities	<b>Requirement types</b> Duration: 02:00 Problem-solving class		<b>Identifying software requirements for an existing software application</b> Individual work Continuous assessment Not Presential Duration: 02:00
2	<b>Software requirements specification</b> Duration: 01:00 Lecture  <b>Software requirements attributes (and relationship with Management)</b> Duration: 00:30 Lecture	<b>Tool support for requirements specification: Rational Requisite Pro</b> Duration: 01:30 Laboratory assignments		<b>Creation a requirement specification using Requisite Pro</b> Individual work Continuous assessment Not Presential Duration: 03:00
3	<b>Requirements validation</b> Duration: 00:40 Lecture  <b>Requirements reviews</b> Duration: 00:20 Lecture	<b>Conduct a requirements review</b> Duration: 00:45 Problem-solving class  <b>Apply validation approaches (user manual, requirements testing)</b> Duration: 01:15 Problem-solving class		<b>Software project proposal</b> Group work Continuous assessment Not Presential Duration: 03:00  <b>Report the validation exercises</b> Individual work Continuous assessment Not Presential Duration: 01:00
4	<b>Requirements elicitation</b> Duration: 00:20 Lecture  <b>Elicitation with interviews</b> Duration: 00:40 Lecture	<b>PROJECT: Conduct the elicitation of a software project using interviews</b> Duration: 01:30 Cooperative activities		<b>Midterm exam</b> Written test Continuous assessment Presential Duration: 00:30  <b>Add elicitation information to DOORS</b> Group work Continuous assessment Not Presential Duration: 04:00



5	<b>Analysis: Overview</b> Duration: 00:20 Lecture  <b>Analysis: Weak techniques</b> Duration: 00:20 Cooperative activities  <b>Analysis: Low-fidelity prototypes</b> Duration: 00:20 Cooperative activities	<b>Perform a checklist-based analysis</b> Duration: 00:30 Problem-solving class  <b>Conduct a low-fidelity prototype evaluation</b> Duration: 00:30 Problem-solving class  <b>Tool support for requirements projects: IBM Doors Next Generation</b> Duration: 01:00 Laboratory assignments		<b>Perform checklist-based analysis using DOORS</b> Group work Continuous assessment Not Presential Duration: 02:00
6		<b>Elicitation: Other techniques, e.g., brainstorming, quizzes, etc.</b> Duration: 02:00 Cooperative activities  <b>PROJECT: Conduct the evaluation of the project's low-fidelity prototype</b> Duration: 01:00 Cooperative activities		<b>Report the prototype evaluation exercise</b> Individual work Continuous assessment Not Presential Duration: 02:00  <b>Add elicitation information to DOORS</b> Group work Continuous assessment Not Presential Duration: 01:00
7		<b>PROJECT: Conduct the elicitation of a software project using interviews</b> Duration: 02:00 Cooperative activities		<b>Add elicitation information to DOORS</b> Group work Continuous assessment Not Presential Duration: 02:00
8	<b>Elicitation: Requirements workshops and focus groups</b> Duration: 01:00 Lecture	<b>PROJECT: Conduct the elicitation of a software project using a requirements workshop</b> Duration: 02:00 Cooperative activities		<b>Add elicitation information to DOORS</b> Group work Continuous assessment Not Presential Duration: 02:00  <b>Creation a preliminary requirement specification using DOORS</b> Group work Continuous assessment Not Presential Duration: 04:00
9	<b>Analysis: Conceptual models</b> Duration: 01:00 Cooperative activities	<b>PROJECT: Create models for the different product perspectives (and enter them in DOORS)</b> Duration: 02:00 Cooperative activities		<b>Report the conceptual models and the cross-checks</b> Group work Continuous assessment Not Presential Duration: 02:00  <b>Creation the final version of the requirement specification using DOORS</b> Group work Continuous assessment Not Presential Duration: 01:00  <b>Conduct the review of the project's software requirements specification</b> Group work Continuous assessment Not Presential Duration: 03:00



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10	<b>Validation: Higher-fidelity prototypes</b> Duration: 00:30 Lecture	<b>Early estimation</b> Duration: 02:00 Problem-solving class		<b>Perform the peer-evaluation of the software requirements specification</b> Group work Continuous assessment Not Presential Duration: 05:00  <b>Midterm exam</b> Written test Continuous assessment Presential Duration: 00:30
11	<b>Requirements management</b> Duration: 00:30 Lecture  <b>Requirements prioritization</b> Duration: 00:30 Lecture  <b>Negotiation</b> Duration: 01:00 Lecture	<b>Perform a change management process</b> Duration: 01:00 Problem-solving class		<b>Report the change management process</b> Individual work Continuous assessment Not Presential Duration: 01:00
12	<b>Triage and release planning</b> Duration: 01:00 Lecture	<b>Perform a triage process</b> Duration: 02:00 Problem-solving class		<b>Report the triage process</b> Group work Continuous assessment Not Presential Duration: 01:00
13	<b>Keynote: Practical experiences managing requirements</b> Duration: 01:00 Additional activities	<b>Human aspects in Requirements Engineering</b> Duration: 02:00 Additional activities		<b>Term paper submission</b> Individual work Continuous assessment Not Presential Duration: 15:00
14	<b>Project: Retrospective</b> Duration: 01:00 Cooperative activities	<b>Seminar: Model checking</b> Duration: 03:00 Problem-solving class		<b>Midterm exam</b> Written test Continuous assessment Presential Duration: 01:00  <b>Term paper presentation submission</b> Individual presentation Continuous assessment Not Presential Duration: 01:30
15		<b>Seminar: Model-driven engineering</b> Duration: 03:00 Laboratory assignments		<b>Development of a simple application using MDA</b> Group work Continuous assessment Not Presential Duration: 04:00
16	<b>Keynote: Artefact-driven Requirements Engineering</b> Duration: 02:00 Lecture			<b>Term paper evaluation</b> Individual work Continuous assessment Not Presential Duration: 02:00



17				<b>Global examination</b> Written test Final examination Presential Duration: 02:00
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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.

\* The schedule is based on an a priori planning of the subject; it might be modified during the academic year, especially considering the COVID19 evolution.



## 6. Activities and assessment criteria

### 6.1. Assessment activities

#### 6.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
1	Identifying software requirements for an existing software application	Individual work	No Presential	02:00	3%	3 / 10	CG1 CE5
2	Creation a requirement specification using Requisite Pro	Individual work	No Presential	03:00	4%	3 / 10	CE5
3	Software project proposal	Group work	No Presential	03:00	2%	3 / 10	CE5 CG3 CG1
3	Report the validation exercises	Individual work	No Presential	01:00	3%	3 / 10	CE5
4	Midterm exam	Written test	Face-to-face	00:30	10%	5 / 10	CE5
4	Add elicitation information to DOORS	Group work	No Presential	04:00	3%	3 / 10	CE5
5	Perform checklist-based analysis using DOORS	Group work	No Presential	02:00	2%	3 / 10	CE5
6	Report the prototype evaluation exercise	Individual work	No Presential	02:00	3%	3 / 10	CG3 CE5
6	Add elicitation information to DOORS	Group work	No Presential	01:00	1%	3 / 10	CE5
7	Add elicitation information to DOORS	Group work	No Presential	02:00	2%	3 / 10	CE5
8	Add elicitation information to DOORS	Group work	No Presential	02:00	2%	3 / 10	CE5
8	Creation a preliminary requirement specification using DOORS	Group work	No Presential	04:00	4%	3 / 10	CE5
9	Report the conceptual models and the cross-checks	Group work	No Presential	02:00	3%	3 / 10	CE5 CG3
9	Creation the final version of the requirement specification using DOORS	Group work	No Presential	01:00	1%	3 / 10	CE5
9	Conduct the review of the project's software requirements specification	Group work	No Presential	03:00	5%	3 / 10	CG1 CE5 CG3





INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

10	Perform the peer-evaluation of the software requirements specification	Group work	No Presential	05:00	10%	3 / 10	CE5 CG3 CG1
10	Midterm exam	Written test	Face-to-face	00:30	10%	5 / 10	CE5
11	Report the change management process	Individual work	No Presential	01:00	2%	3 / 10	CE5 CG3
12	Report the triage process	Group work	No Presential	01:00	3%	3 / 10	CE5 CG3
13	Term paper submission	Individual work	No Presential	15:00	5%	0 / 10	CG1 CE5 CG3
14	Midterm exam	Written test	Face-to-face	01:00	10%	5 / 10	CE5
14	Term paper presentation submission	Individual presentation	No Presential	01:30	2%	0 / 10	CG1 CE5 CG3
15	Development of a simple application using MDA	Group work	No Presential	04:00	5%	3 / 10	CE5
16	Term paper evaluation	Individual work	No Presential	02:00	5%	0 / 10	CG3 CG1 CE5

#### 6.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
17	Global examination	Written test	Face-to-face	02:00	100%	5 / 10	CG1 CE5 CG3

#### 6.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Final exam (extraordinary session)	Written test	Face-to-face	04:00	100%	5 / 10	CG1 CE5 CG3



## 6.2. Assessment criteria

### 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 cooperative activities labeled "**PROJECT:**" are compulsory. Failing to attend these activities without due reason implies failing the project.
- The students cannot retake the course project in the global evaluation. The project requires the cooperation of groups of students and has a pre-specified calendar, including face-to-face sessions. These activities cannot be scheduled at different times because it is not guaranteed that fellow students have other time slots available apart from the ones assigned to the Requirements Engineering course.
- The students cannot retake the term paper. First, this activity does not have a minimum grade, i.e., there is no "fail" grade. Second, the term paper is evaluated using peer review; it implies that the paper should be available at the designated time. Finally, the term paper requires a substantial effort that students cannot likely perform between the submission time and the Global Examination date; these dates correspond to the course evaluation period.

### Global evaluation (January)

- All assignments can be re-submitted and regraded. When the instructors provide the feedback, they will specify a deadline for the resubmission.
- The students can resit the midterm exams in January (on the date/time specified by the administration).
- The project and the term paper cannot be retaken.

### 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 at Moodle.



## 7. Teaching resources

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### 7.1. Teaching resources for the subject

Name	Type	Notes
Course material	Web resource	All required materials will be available at moodle

**7.1.2 Software Architecture**



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

COORDINATION PROCESS OF  
LEARNING ACTIVITIES  
PR/CL/001



E.T.S. de Ingenieros  
Informaticos

# ANX-PR/CL/001-01

## LEARNING GUIDE

### SUBJECT

**103000484 - Software Architecture**

### DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

### ACADEMIC YEAR & SEMESTER

2022/23 - Semester 2



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

## Index

---

### Learning guide

1. Description.....	1
2. Faculty.....	1
3. Prior knowledge recommended to take the subject.....	2
4. Skills and learning outcomes .....	2
5. Brief description of the subject and syllabus.....	3
6. Schedule.....	5
7. Activities and assessment criteria.....	8
8. Teaching resources.....	10



## 1. Description

### 1.1. Subject details

<b>Name of the subject</b>	103000484 - Software Architecture
<b>No of credits</b>	4 ECTS
<b>Type</b>	Compulsory
<b>Academic year of the programme</b>	First year
<b>Semester of tuition</b>	Semester 2
<b>Tuition period</b>	February-June
<b>Tuition languages</b>	English
<b>Degree programme</b>	10AM - Master Universitario en Ingeniería del Software
<b>Centre</b>	10 - Escuela Técnica Superior De Ingenieros Informáticos
<b>Academic year</b>	2022-23

## 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 timetable is available at: <a href="https://docs.google.com/spreadsheets/d/1Zi99dtPBXiFFJg4HUSAUelj2M0QijPUeTSmv1FTeNOY/edit#gid=0">https://docs.google.com/spreadsheets/d/1Zi99dtPBXiFFJg4HUSAUelj2M0QijPUeTSmv1FTeNOY/edit#gid=0</a>



Angelica De Antonio Jimenez	5108	angelica.deantonio@upm.es	Sin horario. The tutoring timetable is available at: <a href="https://docs.google.com/spreadsheets/d/1Zi99dtPBXiFFJg4HUSAUelj2M0QijPUeTSmv1FTeNOY/edit#gid=0">https://docs.google.com/spreadsheets/d/1Zi99dtPBXiFFJg4HUSAUelj2M0QijPUeTSmv1FTeNOY/edit#gid=0</a>
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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 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

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#### 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.



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

## 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



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

## 6. Schedule

### 6.1. Subject schedule\*

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



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

6	<b>Practical exercises on topics that are being explained in classroom</b> Duration: 01:00 Cooperative activities  <b>Architectural styles</b> Duration: 01:00 Lecture			
7	<b>Architectural styles</b> Duration: 01:00 Lecture  <b>Practical exercises on topics that are being explained in classroom</b> Duration: 01:00 Cooperative activities			<b>Practical exercises on topics that are being explained in classroom</b> Group work Continuous assessment Not Presential Duration: 05:00
8	<b>Architectural styles</b> Duration: 01:00 Lecture  <b>Practical exercises on topics that are being explained in classroom</b> Duration: 01:00 Cooperative activities			
9	<b>Practical exercises on topics that are being explained in classroom</b> Duration: 01:00 Cooperative activities  <b>Architectural patterns</b> Duration: 01:00 Lecture			<b>Practical exercises on topics that are being explained in classroom</b> Group work Continuous assessment Not Presential Duration: 05:00
10	<b>Practical exercises on topics that are being explained in classroom</b> Duration: 01:00 Cooperative activities  <b>Architectural patterns</b> Duration: 01:00 Lecture			
11	<b>Presentations of the project proposals</b> Duration: 01:00 Additional activities  <b>Architectural patterns</b> Duration: 01:00 Lecture			<b>Project</b> Group work Continuous assessment Not Presential Duration: 12:00
12	<b>Architectural patterns</b> Duration: 01:00 Lecture  <b>Practical exercises on topics that are being explained in classroom</b> Duration: 01:00 Cooperative activities			<b>Project</b> Group work Continuous assessment Not Presential Duration: 20:00



13	<b>Architectural patterns</b> Duration: 01:00 Lecture  <b>Practical exercises on topics that are being explained in classroom</b> Duration: 01:00 Cooperative activities			<b>Project</b> Group work Continuous assessment Not Presential Duration: 20:00
14	<b>Oral presentations of the projects</b> Duration: 02:00 Additional activities			<b>Project</b> Group work Continuous assessment Not Presential Duration: 09:00
15				<b>Exam</b> Written test Continuous assessment Presential Duration: 02:00
16				
17				<b>Final Exam</b> Written test Final examination Presential Duration: 01:00

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.

\* The schedule is based on an a priori planning of the subject; it might be modified during the academic year, especially considering the COVID19 evolution.



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

## 7. Activities and assessment criteria

### 7.1. Assessment activities

#### 7.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
3	Practical exercises on topics that are being explained in classroom	Group work	No Presential	03:00	5%	0 / 10	CE12
7	Practical exercises on topics that are being explained in classroom	Group work	No Presential	05:00	10%	0 / 10	CE12
9	Practical exercises on topics that are being explained in classroom	Group work	No Presential	05:00	10%	0 / 10	CE12
11	Project	Group work	No Presential	12:00	10%	5 / 10	CG1 CG14 CG18 CE12 CG3
12	Project	Group work	No Presential	20:00	10%	5 / 10	
13	Project	Group work	No Presential	20:00	10%	5 / 10	CG1 CG14 CG18 CE12 CG3
14	Project	Group work	No Presential	09:00	20%	5 / 10	CG1 CG14 CG18 CE12 CG3
15	Exam	Written test	Face-to-face	02:00	25%	4 / 10	CE12

#### 7.1.2. Global examination

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

## 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.

Additionally, 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. So, **students will have to attend some prefixed classes associated with evaluation activities, which will be reported in the first class of the subject, and at least 60% of the classes to pass the subject in the regular period.** However, if a student cannot attend a lesson for some justified reason (job duties, illness, etc.), he/she will be able to compensate for a non-attendance by doing the replacement task required by the professor in due course.

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:



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

$FG = 0.25 \cdot PAG + 0.25 \cdot EG + 0.5 \cdot PG + 0.05 \cdot CPG$  if  $EG \geq 4$  and  $PG \geq 5$  and  $CPG \geq 6$

$FG = 0$  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	<a href="http://moodle.upm.es/titulaciones/oficiales/course/view.php?id=2835">http://moodle.upm.es/titulaciones/oficiales/course/view.php?id=2835</a>
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	

**7.1.3 Software Design**



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

COORDINATION PROCESS OF  
LEARNING ACTIVITIES  
PR/CL/001



E.T.S. de Ingenieros  
Informaticos

# ANX-PR/CL/001-01

## LEARNING GUIDE

### SUBJECT

**103000483 - Software Design**

### DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

### ACADEMIC YEAR & SEMESTER

2022/23 - Semester 2



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

## Index

---

### Learning guide

1. Description.....	1
2. Faculty.....	1
3. Prior knowledge recommended to take the subject.....	2
4. Skills and learning outcomes .....	2
5. Brief description of the subject and syllabus.....	4
6. Schedule.....	6
7. Activities and assessment criteria.....	8
8. Teaching resources.....	9



## 1. Description

### 1.1. Subject details

<b>Name of the subject</b>	103000483 - Software Design
<b>No of credits</b>	4 ECTS
<b>Type</b>	Compulsory
<b>Academic year of the programme</b>	First year
<b>Semester of tuition</b>	Semester 2
<b>Tuition period</b>	February-June
<b>Tuition languages</b>	English
<b>Degree programme</b>	10AM - Master Universitario en Ingeniería del Software
<b>Centre</b>	10 - Escuela Técnica Superior De Ingenieros Informáticos
<b>Academic year</b>	2022-23

## 2. Faculty

### 2.1. Faculty members with subject teaching role

<b>Name and surname</b>	<b>Office/Room</b>	<b>Email</b>	<b>Tutoring hours *</b>
Nelson Medinilla Martinez (Subject coordinator)	5109	nelson.medinilla@upm.es	M - 16:00 - 18:00
Natalia Juristo Juzgado	5110	natalia.juristo@upm.es	M - 08:00 - 08:15

\* 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

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#### 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 \*

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#### 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

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

RA21 - Listening capability SC13, SC14, CG10 A

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.

INTERNATIONAL  
CAMPUS OF  
EXCELLENCEPR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIESANX-PR/CL/001-01  
LEARNING GUIDEE.T.S. de Ingenieros  
Informáticos

## 5. Brief description of the subject and syllabus

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### 5.1. Brief description of the subject

The course Software Design is aimed at enhancing human efficiency in software development. Therefore, the purpose of this course is to develop the skills to design software systems such that meet the following conditions (set by Parnas): Managerial, Flexibility, Comprehension.

These are the skills that will be evaluated in the course.

The course is essentially practical; it relies on a small and intense theoretical core: Near Decomposable Systems, Information Hiding Principle and Bi-dimensional Complexity.

Difficulties (hard):

These skill are creative, no algorithms or recipes for a design that meets the conditions set by Parnas.

Very often we have entrenched ideas that hinder the acquisition of the necessary skills.





INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

## 5.2. Syllabus

1. Software Engineering Two-dimensional Complexity
2. System Software Design Features
3. Object Oriented Review
4. Design and Dominion Patterns



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

## 6. Schedule

### 6.1. Subject schedule\*

Week	Classroom activities	Laboratory activities	Distant / On-line	Assessment activities
1	<b>Software Engineering Two-dimensional Complexity</b> Duration: 02:00 Lecture			
2	<b>Object Oriented Review</b> Duration: 02:00 Lecture			
3	<b>Workshop</b> Duration: 02:00 Cooperative activities			
4	<b>System Software Design Features</b> Duration: 02:00 Lecture			
5	<b>Workshop</b> Duration: 02:00 Cooperative activities			
6	<b>Workshop</b> Duration: 01:00 Cooperative activities			<b>Test</b> Written test Continuous assessment Presential Duration: 01:00
7	<b>Workshop</b> Duration: 02:00 Cooperative activities			
8	<b>Design and Dominion Patterns</b> Duration: 02:00 Lecture			
9	<b>Workshop</b> Duration: 02:00 Cooperative activities			
10	<b>Workshop</b> Duration: 02:00 Cooperative activities			
11	<b>Workshop</b> Duration: 01:00 Cooperative activities			<b>Test</b> Written test Continuous assessment Presential Duration: 01:00
12	<b>Workshop</b> Duration: 02:00 Cooperative activities			



13	<b>Workshop</b> Duration: 02:00 Cooperative activities			
14	<b>Workshop</b> Duration: 02:00 Cooperative activities			
15				<b>Oral presentation of the final work</b> Group work Continuous assessment Presential Duration: 02:00
16				<b>Test recoveries.</b> Written test Continuous assessment 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.

\* The schedule is based on an a priori planning of the subject; it might be modified during the academic year, especially considering the COVID19 evolution.



## 7. Activities and assessment criteria

### 7.1. Assessment activities

#### 7.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
6	Test	Written test	Face-to-face	01:00	20%	3 / 10	CE12 CG11
11	Test	Written test	Face-to-face	01:00	25%	3 / 10	CE12 CG11
15	Oral presentation of the final work	Group work	Face-to-face	02:00	55%	/ 10	CG1 CG10 CG14 CG18 CE12 CG11 CG3
16	Test recoveries.	Written test	Face-to-face	02:00	%	3 / 10	CE12 CG11

#### 7.1.2. Global examination

No se ha definido la evaluación sólo por prueba final.

#### 7.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Global test	Individual work	Face-to-face	02:00	100%	5 / 10	CG11 CE12 CG10



## 7.2. Assessment criteria

The course applies a continuous evaluation through individual evaluation activities (45%) and final work as teamwork (55%).

To pass the course, two conditions are necessary: first, exceed the minimum mark in each test and also obtain 50% (5/10) of the total score (test + teamwork).

In case of not exceeding the minimum required grade, the test may be recovered in the ordinary call. The teamwork is unrecoverable.

## 8. Teaching resources

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### 8.1. Teaching resources for the subject

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

## **7.2 Project Management and Organizational Processes Module**

### **7.2.1 Models and Methods for Process Improvement and Assessment**



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## LEARNING GUIDE

### SUBJECT

**103000486 - Models And Methods For Process Improvement And Assessments**

### DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

### ACADEMIC YEAR & SEMESTER

2022/23 - Semester 1



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LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



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Informáticos

## Index

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### Learning guide

1. Description.....	1
2. Faculty.....	1
3. Prior knowledge recommended to take the subject.....	2
4. Skills and learning outcomes .....	2
5. Brief description of the subject and syllabus.....	3
6. Schedule.....	5
7. Activities and assessment criteria.....	9
8. Teaching resources.....	13





## 1. Description

### 1.1. Subject details

<b>Name of the subject</b>	103000486 - Models And Methods For Process Improvement And Assessments
<b>No of credits</b>	4 ECTS
<b>Type</b>	Compulsory
<b>Academic year of the programme</b>	First year
<b>Semester of tuition</b>	Semester 1
<b>Tuition period</b>	September-January
<b>Tuition languages</b>	English
<b>Degree programme</b>	10AM - Master Universitario en Ingeniería del Software
<b>Centre</b>	10 - Escuela Tecnica Superior De Ingenieros Informaticos
<b>Academic year</b>	2022-23

## 2. Faculty

### 2.1. Faculty members with subject teaching role

<b>Name and surname</b>	<b>Office/Room</b>	<b>Email</b>	<b>Tutoring hours *</b>
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	W - 10:00 - 13:00 Th - 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

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#### 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

RA37 - Está capacitado para introducir mejoras en la organización

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

RA36 - Posee dotes para liderar el cambio dentro de la 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

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### 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



(maturity/capability levels, and institutionalization).

Finally, students will have to choose one of the processes of the ITIL model 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. A process model focused on IT Services



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## 6. Schedule

### 6.1. Subject schedule\*

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



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PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



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Informáticos

5				
6	<p><b>Chapter 2: Process Improvement life cycles: AFIM: Assessment</b> Duration: 01:30 Lecture</p> <p><b>Exercise related to ROI in Assessment</b> Duration: 00:30 Problem-solving class</p>			<p><b>Discussion/Participating in class (NON-RECOVERABLE)</b> Other assessment Continuous assessment Presential Duration: 01:00</p>
7	<p><b>Chapter 2: Process Improvement life cycles: AFIM: Assessment</b> Duration: 01:30 Lecture</p> <p><b>Exercise related to ROI in Assessment</b> Duration: 00:30 Problem-solving class</p>			<p><b>Discussion/Participating in class (NON-RECOVERABLE)</b> Other assessment Continuous assessment Presential Duration: 01:00</p>
8	<p><b>Chapter 2: Process Improvement life cycles: AFIM: Action Plan and Implementation</b> Duration: 00:30 Lecture</p> <p><b>Exercise related to ROI in Action Plans and Implementation</b> Duration: 00:30 Problem-solving class</p>			<p><b>Discussion/Participating in class (NON-RECOVERABLE)</b> Other assessment Continuous assessment Presential Duration: 01:00</p> <p><b>Exercise related to ROI in Assessment</b> Group work Continuous assessment Presential Duration: 01:00</p>
9				
10	<p><b>Chapter 2: Process Improvement life cycles: AFIM: Action Plans and Implementation</b> Duration: 01:00 Lecture</p> <p><b>Exercise related to ROI in Action Plans and Implementation</b> Duration: 00:30 Problem-solving class</p> <p><b>Exercise related to ROI in a Small Enterprise (statement)</b> Duration: 00:30 Problem-solving class</p>			<p><b>Discussion/Participating in class (NON-RECOVERABLE)</b> Other assessment Continuous assessment Presential Duration: 01:00</p>
11				<p><b>Discussion/Participating in class (NON-RECOVERABLE)</b> Other assessment Continuous assessment Presential Duration: 01:00</p> <p><b>Exercise related to ROI in Action Plans and Implementation</b> Group work Continuous assessment Presential Duration: 01:00</p> <p><b>Exercise related to ROI in Summary</b> Group work Continuous assessment</p>



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LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

				<p>Presential Duration: 01:00</p>
12	<p><b>Chapter 3: Process Models oriented to services</b> Duration: 00:30 Lecture</p> <p><b>Exercise related to ITIL (statement)</b> Duration: 00:30 Problem-solving class</p>			<p><b>Discussion/Participating in class (NON-RECOVERABLE)</b> Other assessment Continuous assessment Presential Duration: 01:00</p> <p><b>Exercise related to ROI in a Small Enterprise</b> Group work Continuous assessment Presential Duration: 01:00</p>
13	<p><b>Chapter 3: CMMI</b> Duration: 02:00 Lecture</p>			<p><b>Discussion/Participating in class (NON-RECOVERABLE)</b> Other assessment Continuous assessment Presential Duration: 01:00</p>
14	<p><b>Chapter 3: CMMI</b> Duration: 02:00 Lecture</p>			<p><b>Discussion/Participating in class (NON-RECOVERABLE)</b> Other assessment Continuous assessment Presential Duration: 01:00</p>
15				<p><b>Discussion/Participating in class (NON-RECOVERABLE)</b> Other assessment Continuous assessment Presential Duration: 01:00</p> <p><b>Presentation related to a selected Service Process</b> Individual presentation Continuous assessment Presential Duration: 01:00</p> <p><b>Progressive Evaluation</b> Written test Continuous assessment Presential Duration: 01:00</p>
16				<p><b>Discussion/Participating in class (NON-RECOVERABLE)</b> Other assessment Continuous assessment Presential Duration: 01:00</p> <p><b>Presentation related to a selected Service Process</b> Individual presentation Continuous assessment Presential Duration: 02:00</p>



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LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



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17				<b>Global Evaluation</b> Written test Final examination Presential Duration: 03:00
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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.

\* The schedule is based on an a priori planning of the subject; it might be modified during the academic year, especially considering the COVID19 evolution.





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Informáticos

## 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	01:00	1%	5 / 10	CG1 CG18
2	Discussion/Participating in class (NON-RECOVERABLE)	Other assessment	Face-to-face	01:00	1%	5 / 10	CG1 CG18
3	Discussion/Participating in class (NON-RECOVERABLE)	Other assessment	Face-to-face	01:00	1%	5 / 10	CG1 CG18 CE9 CE10
4	Discussion/Participating in class (NON-RECOVERABLE)	Other assessment	Face-to-face	01:00	1%	5 / 10	CG1 CG18 CE9 CE10
4	Exercise related to ROI in Commitment	Other assessment	Face-to-face	01:00	10%	5 / 10	CG1 CG3 CG18 CG17 CE9 CE10
6	Discussion/Participating in class (NON-RECOVERABLE)	Other assessment	Face-to-face	01:00	1%	5 / 10	CG1 CG18 CE9 CE10
7	Discussion/Participating in class (NON-RECOVERABLE)	Other assessment	Face-to-face	01:00	1%	5 / 10	CG1 CG18 CE9 CE10
8	Discussion/Participating in class (NON-RECOVERABLE)	Other assessment	Face-to-face	01:00	1%	5 / 10	CG1 CG18 CE9 CE10
8	Exercise related to ROI in Assessment	Group work	Face-to-face	01:00	10%	5 / 10	CG1 CG3 CG18 CG17 CE9 CE10



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LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



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10	Discussion/Participating in class (NON-RECOVERABLE)	Other assessment	Face-to-face	01:00	1%	5 / 10	CG1 CE9 CG18 CE10
11	Discussion/Participating in class (NON-RECOVERABLE)	Other assessment	Face-to-face	01:00	2%	5 / 10	CG1 CG18 CE9 CE10
11	Exercise related to ROI in Action Plans and Implementation	Group work	Face-to-face	01:00	10%	5 / 10	CG1 CG3 CG18 CG17 CE9 CE10
11	Exercise related to ROI in Summary	Group work	Face-to-face	01:00	5%	5 / 10	CG1 CG3 CG18 CE9 CG17 CE10
12	Discussion/Participating in class (NON-RECOVERABLE)	Other assessment	Face-to-face	01:00	1%	5 / 10	CG1 CG3 CG18 CE10
12	Exercise related to ROI in a Small Enterprise	Group work	Face-to-face	01:00	10%	5 / 10	CG3 CG18 CG17 CG1 CE10
13	Discussion/Participating in class (NON-RECOVERABLE)	Other assessment	Face-to-face	01:00	1%	5 / 10	CG1 CG3 CG18 CE10
14	Discussion/Participating in class (NON-RECOVERABLE)	Other assessment	Face-to-face	01:00	1%	5 / 10	CG1 CG3 CG18 CE10
15	Discussion/Participating in class (NON-RECOVERABLE)	Other assessment	Face-to-face	01:00	1%	5 / 10	CG1 CG3 CG18 CE9
15	Presentation related to a selected Service Process	Individual presentation	Face-to-face	01:00	10%	5 / 10	CG1 CG3 CG18 CE9
15	Progressive Evaluation	Written test	Face-to-face	01:00	20%	5 / 10	CG1 CG3 CE9 CE10



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PR/CL/001  
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LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



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Informáticos

16	Discussion/Participating in class (NON-RECOVERABLE)	Other assessment	Face-to-face	01:00	1%	5 / 10	CG1 CG3 CG18 CE9
16	Presentation related to a selected Service Process	Individual presentation	Face-to-face	02:00	10%	5 / 10	CG1 CG3 CG18 CE9

### 7.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
17	Global Evaluation	Written test	Face-to-face	03:00	85%	5 / 10	CG1 CG3 CG18 CG17 CE9 CE10

### 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	85%	5 / 10	CG1 CG3 CG18 CG17 CE9 CE10



## 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.
2. Group Exercises related to Return on Investment (ROI) in Commitment (10%), Assessment (10%), Action Plans and Implementation (10%), and Summary (5%)
3. Group Exercise related to ROI in a Small enterprise (10%).
4. Individual research work based on a service process from ITIL (20%). This activity is divided into two ones. One related to the individual skills in communications (10%) and the other one related to the memory of the work itself (10%).
5. Individual Progressive evaluation exam (20%) related to the main concepts of the subject.

The previous assessment activities can be recovered (except activity 1), if failed, in the Global Evaluation Test (17 week)

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.

In the global evaluation (week 17), 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.

In the "convocatoria extraordinaria", the same thing happens: the grade of the "final test" 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
ITIL	Bibliography	ITIL -Information Technology Infrastructure Library (Service Strategy, Service Design, Service Transition, Service Operation, Continual Service Improvement)
CMMI Model V2.0	Bibliography	CMMI Institute, CMMI V2.1 Model, December 2018

**7.2.2 Software Project Management**



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## LEARNING GUIDE

### SUBJECT

**103000485 - Software Project Management**

### DEGREE PROGRAMME

10AM - Master Universitario En Ingeniería Del Software

### ACADEMIC YEAR & SEMESTER

2022/23 - Semester 1



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PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

## Index

---

### Learning guide

1. Description.....	1
2. Faculty.....	1
3. Skills and learning outcomes .....	2
4. Brief description of the subject and syllabus.....	3
5. Schedule.....	5
6. Activities and assessment criteria.....	7
7. Teaching resources.....	9





## 1. Description

### 1.1. Subject details

<b>Name of the subject</b>	103000485 - Software Project Management
<b>No of credits</b>	4 ECTS
<b>Type</b>	Compulsory
<b>Academic year of the programme</b>	First year
<b>Semester of tuition</b>	Semester 1
<b>Tuition period</b>	September-January
<b>Tuition languages</b>	English
<b>Degree programme</b>	10AM - Master Universitario en Ingenieria del Software
<b>Centre</b>	10 - Escuela Tecnica Superior De Ingenieros Informaticos
<b>Academic year</b>	2022-23

## 2. Faculty

### 2.1. Faculty members with subject teaching role

<b>Name and surname</b>	<b>Office/Room</b>	<b>Email</b>	<b>Tutoring hours *</b>
Jose Antonio Calvo-Manzano Villalon	5105	joseantonio.calvomanzano@upm.es	Tu - 10:00 - 14:00 Th - 10:00 - 12:00
Ana Maria Moreno Sanchez-Capuchino (Subject coordinator)	5102	anamaria.moreno@upm.es	M - 15:00 - 21:00

\* 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 \*

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#### 3.1. Skills to be learned

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



### 3.2. Learning outcomes

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

\* 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 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. Syllabus

1. Introduction to Software Project Management
  - 1.1. 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. Schedule

### 5.1. Subject schedule\*

Week	Classroom activities	Laboratory activities	Distant / On-line	Assessment activities
1	<b>Chapter 1</b> Duration: 02:00 Lecture			
2	<b>Software Project Management Model (Lego)</b> Duration: 02:00 Cooperative activities			
3	<b>Chapter 2</b> Duration: 02:00 Lecture			
4	<b>Chapter 2. Know your team</b> Duration: 02:00 Cooperative activities			
5	<b>Chapter 3</b> Duration: 02:00 Lecture			
6	<b>Chapter 4</b> Duration: 02:00 Lecture			
7	<b>Chapter 4. Building Blocks</b> Duration: 02:00 Cooperative activities			
8	<b>SPM Complementary Knowledge</b> Duration: 02:00 Cooperative activities			
9	<b>Chapter 5</b> Duration: 02:00 Lecture			
10	<b>Chapter 5.</b> Duration: 02:00 Cooperative activities			
11	<b>Chapter 6</b> Duration: 02:00 Cooperative activities			
12	<b>Chapter 6</b> Duration: 02:00 Cooperative activities	<b>Software Project Management Model (Lego)</b> Duration: 02:00 Cooperative activities		
13	<b>Chapter 6</b> Duration: 02:00 Cooperative activities	<b>Soft Skills Management</b> Duration: 02:00 Cooperative activities		



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PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

14	Chapter 6 Duration: 02:00 Cooperative activities			Active participation of students Other assessment Continuous assessment and final examination Not Presential Duration: 00:00
15	Chapter 6 Duration: 02:00 Cooperative activities			Final Report Group work Continuous assessment Not Presential Duration: 00:00  Presentation of Final Report Group work Continuous assessment Presential Duration: 01:00  Final Report Individual presentation Final examination Presential Duration: 02:00
16	Industrial Seminar Duration: 02:00 Additional activities			
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.

\* The schedule is based on an a priori planning of the subject; it might be modified during the academic year, especially considering the COVID19 evolution.



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

## 6. Activities and assessment criteria

### 6.1. Assessment activities

#### 6.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
14	Active participation of students	Other assessment	No Presential	00:00	15%	0 / 10	CG2 CG1
15	Final Report	Group work	No Presential	00:00	70%	5 / 10	CE1 CE3 CE2 CG5 CG18 CG2 CG14 CG1
15	Presentation of Final Report	Group work	Face-to-face	01:00	15%	5 / 10	CE1 CE3 CE2 CG5 CG18 CG2 CG14 CG1

#### 6.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
14	Active participation of students	Other assessment	No Presential	00:00	15%	0 / 10	CG2 CG1
15	Final Report	Individual presentation	Face-to-face	02:00	85%	5 / 10	CE1 CE3 CE2 CG5 CG18 CG2 CG14 CG1



### 6.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Content of Final Project Report	Individual work	Face-to-face	00:00	85%	5 / 10	CE1 CE3 CE2 CG5 CG18 CG2 CG14 CG1
Active participation of students	Other assessment	Face-to-face	00:00	15%	0 / 10	CE1 CE3 CE2

### 6.2. Assessment criteria

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 (15%)
- Content of the reports (70%)
- Presentation of the report (15%)

Students must get a minimum of 5 points (over 10) in the assessment of each 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 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. Teaching resources

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### 7.1. Teaching resources for the subject

Name	Type	Notes
Bibliography	Bibliography	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.  

### **7.3 Support Processes Module**

#### **7.3.1 Software Metrics**



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CAMPUS OF  
EXCELLENCE

COORDINATION PROCESS OF  
LEARNING ACTIVITIES  
PR/CL/001



E.T.S. de Ingenieros  
Informaticos

# ANX-PR/CL/001-01

## LEARNING GUIDE

### SUBJECT

**103000488 - Software Metrics**

### DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

### ACADEMIC YEAR & SEMESTER

2022/23 - Semester 1



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

## Index

---

### Learning guide

1. Description.....	1
2. Faculty.....	1
3. Skills and learning outcomes .....	2
4. Brief description of the subject and syllabus.....	3
5. Schedule.....	4
6. Activities and assessment criteria.....	7
7. Teaching resources.....	9



## 1. Description

### 1.1. Subject details

<b>Name of the subject</b>	103000488 - Software Metrics
<b>No of credits</b>	4 ECTS
<b>Type</b>	Compulsory
<b>Academic year of the programme</b>	First year
<b>Semester of tuition</b>	Semester 1
<b>Tuition period</b>	September-January
<b>Tuition languages</b>	English
<b>Degree programme</b>	10AM - Master Universitario en Ingenieria del Software
<b>Centre</b>	10 - Escuela Tecnica Superior De Ingenieros Informaticos
<b>Academic year</b>	2022-23

## 2. Faculty

### 2.1. Faculty members with subject teaching role

<b>Name and surname</b>	<b>Office/Room</b>	<b>Email</b>	<b>Tutoring hours *</b>
Tomas San Feliu Gilabert (Subject coordinator)	5106	tomas.sanfeliu@upm.es	W - 10:00 - 13:00 Th - 10:00 - 13:00
Nelson Medinilla Martinez	5019	nelson.medinilla@upm.es	Tu - 11:00 - 14:00 F - 11:00 - 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 \*

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#### 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

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

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

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

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### 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
6. Visualization and Decision Making with Software Measurements



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CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

## 5. Schedule

### 5.1. Subject schedule\*

Week	Classroom activities	Laboratory activities	Distant / On-line	Assessment activities
1	Chapter 1.1 Why Measure Chapter 1.2 Measure Elements Duration: 02:00 Lecture			
2	Chapter 2.1 Measuring Internal Product Attributes Duration: 02:00 Lecture			<b>Quiz 1</b> Online test Continuous assessment Not Presential Duration: 00:30
3	Chapter 2.1 Measuring Internal Product Attributes Duration: 02:00 Lecture			<b>Reading 1</b> Individual work Continuous assessment Presential Duration: 02:00
4	Chapter 2.2 Measuring External Product Attributes Duration: 02:00 Lecture			
5	Chapter 3 Measuring Process Duration: 02:00 Lecture			<b>Quiz 2</b> Online test Continuous assessment Not Presential Duration: 00:30
6	Chapter 4. Designing Metrics Program Duration: 02:00 Lecture			
7	Chapter 4. Designing Metrics Program Duration: 02:00 Lecture			<b>Reading 2</b> Individual work Continuous assessment Presential Duration: 02:00
8	Chapter 4. Designing Metrics Program Duration: 02:00 Lecture			<b>Measurement Goal Definition</b> Group work Continuous assessment Presential Duration: 02:00
9	Chapter 4. Designing Metrics Program Duration: 02:00 Lecture			<b>Quiz 3</b> Online test Continuous assessment Not Presential Duration: 00:30





INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

10	<b>Chapter 4. Designing Metrics Program</b> Duration: 02:00 Lecture			
11	<b>Chapter 4. Designing Metrics Program</b> Duration: 02:00 Lecture			
12	<b>Chapter 5. Frameworks for Software Measurements</b> Duration: 02:00 Lecture			<b>Reading 3</b> Individual work Continuous assessment Presential Duration: 02:00  <b>Quiz 4</b> Online test Continuous assessment Not Presential Duration: 00:30
13	<b>Chapter 5. Frameworks for Software Measurements</b> Duration: 02:00 Lecture			
14	<b>Chapter 6 Visualization and Decision Making with Software Measurements</b> Duration: 02:00 Lecture			<b>Final Report</b> Group work Continuous assessment Presential Duration: 02:00
15	<b>Chapter 6 Visualization and Decision Making with Software Measurements</b> Duration: 01:00 Lecture			
16				
17				<b>Final Test</b> Online test Continuous assessment Not Presential Duration: 02:00  <b>Final Test</b> Online test Final examination Presential Duration: 00:30  <b>Final Reading</b> Individual work Final examination Not Presential Duration: 00:30  <b>Measurement Goal Update</b> Group work Final examination Not Presential Duration: 00:00  <b>Final Report Update</b> Group work Final examination Not Presential Duration: 00:00



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

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.

\* The schedule is based on an a priori planning of the subject; it might be modified during the academic year, especially considering the COVID19 evolution.



## 6. Activities and assessment criteria

### 6.1. Assessment activities

#### 6.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
2	Quiz 1	Online test	No Presential	00:30	5%	0 / 10	CE10 CG2 CG18
3	Reading 1	Individual work	Face-to-face	02:00	2%	0 / 10	CG18
5	Quiz 2	Online test	No Presential	00:30	5%	4 / 10	CE10
7	Reading 2	Individual work	Face-to-face	02:00	2%	0 / 10	CG18
8	Measurement Goal Definition	Group work	Face-to-face	02:00	20%	4 / 10	CG12 CE10
9	Quiz 3	Online test	No Presential	00:30	5%	4 / 10	CE10 CG2 CG18
12	Reading 3	Individual work	Face-to-face	02:00	2%	0 / 10	CG18
12	Quiz 4	Online test	No Presential	00:30	5%	4 / 10	CE10 CG2 CG18
14	Final Report	Group work	Face-to-face	02:00	25%	4 / 10	CG2 CG12 CG18 CG1
17	Final Test	Online test	No Presential	02:00	29%	5 / 10	CE10 CG2 CG18

#### 6.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
17	Final Test	Online test	Face-to-face	00:30	49%	5 / 10	CG18 CE10 CG2



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

17	Final Reading	Individual work	No Presential	00:30	6%	0 / 10	CG18
17	Measurement Goal Update	Group work	No Presential	00:00	20%	4 / 10	CE10 CG12
17	Final Report Update	Group work	No Presential	00:00	25%	4 / 10	CG2 CG12 CG1 CE10

### 6.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Final Test	Written test	Face-to-face	00:30	49%	5 / 10	CE10 CG2 CG18
Final reading	Individual work	Face-to-face	00:30	6%	0 / 10	CG18
Measurement Goal Update	Individual work	Face-to-face	00:30	20%	4 / 10	CE10 CG12
Final Report Update	Individual work	Face-to-face	00:30	25%	4 / 10	CE10 CG2 CG12 CG1

### 6.2. Assessment criteria

The student passes the subject only if 5 or more points on 10 are obtained at the end of the course.

The final evaluation of the students is based on, quiz (10%), a measurement initial report exam(20%), an final report(30%) and an individual quiz(25%).

Class participation and additional activities in the classroom are performed. These additional activities represent a 15% of the final scoring.



When failed, the quiz and exams can be repeated in the ordinary evaluation period, using the new marks together to the ones obtained in individual and group exercises and student participation in the previous period to calculate the final grade of the subject.

Finally, In the extraordinary evaluation period a collection of test will be carried out in order to calculate the final grade of the subject.

## 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

**7.3.2 Verification and Validation**



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

COORDINATION PROCESS OF  
LEARNING ACTIVITIES  
PR/CL/001



E.T.S. de Ingenieros  
Informaticos

## ANX-PR/CL/001-01

### LEARNING GUIDE

#### SUBJECT

**103000489 - Verification And Validation**

#### DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

#### ACADEMIC YEAR & SEMESTER

2022/23 - Semester 1



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

## Index

---

### Learning guide

1. Description.....	1
2. Faculty.....	1
3. Prior knowledge recommended to take the subject.....	2
4. Skills and learning outcomes .....	2
5. Brief description of the subject and syllabus.....	3
6. Schedule.....	5
7. Activities and assessment criteria.....	8
8. Teaching resources.....	12





## 1. Description

### 1.1. Subject details

<b>Name of the subject</b>	103000489 - Verification And Validation
<b>No of credits</b>	6 ECTS
<b>Type</b>	Compulsory
<b>Academic year of the programme</b>	First year
<b>Semester of tuition</b>	Semester 1
<b>Tuition period</b>	September-January
<b>Tuition languages</b>	English
<b>Degree programme</b>	10AM - Master Universitario en Ingeniería del Software
<b>Centre</b>	10 - Escuela Técnica Superior De Ingenieros Informáticos
<b>Academic year</b>	2022-23

## 2. Faculty

### 2.1. Faculty members with subject teaching role

<b>Name and surname</b>	<b>Office/Room</b>	<b>Email</b>	<b>Tutoring hours *</b>
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

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#### 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 \*

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#### 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



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

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### 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. Static evaluation

##### 2.1. Introduction to static evaluation

##### 2.2. Static evaluation techniques

##### 2.3. Reading techniques

#### 3. Dynamic evaluation: Software testing

##### 3.1. Introduction to software testing



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

3.2. Testing levels

3.3. The testing process

3.4. Software verification and validation plan

3.5. Testing tools



## 6. Schedule

### 6.1. Subject schedule\*

Week	Classroom activities	Laboratory activities	Distant / On-line	Assessment activities
1	<b>Course introduction</b> Duration: 01:00 Lecture  <b>Static evaluation</b> Duration: 01:00 Lecture  <b>Introduction to software testing</b> Duration: 02:00 Lecture			
2	<b>Static evaluation</b> Duration: 02:00 Lecture  <b>Testing</b> Duration: 02:00 Lecture			
3	<b>Testing</b> Duration: 02:00 Lecture			<b>Static techniques exercise</b> Individual work Continuous assessment Not Presential Duration: 02:00
4	<b>Static evaluation</b> Duration: 01:00 Lecture  <b>Static evaluation</b> Duration: 01:00 Problem-solving class  <b>Testing</b> Duration: 02:00 Problem-solving class			
5	<b>Static evaluation</b> Duration: 01:00 Lecture  <b>Static evaluation</b> Duration: 01:00 Problem-solving class			<b>White box exercise</b> Individual work Continuous assessment Not Presential Duration: 02:00
6	<b>Static evaluation</b> Duration: 01:00 Lecture  <b>Static evaluation</b> Duration: 01:00 Problem-solving class  <b>Testing</b>			



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CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

	Duration: 02:00 Lecture			
7	<b>Testing</b> Duration: 02:00 Problem-solving class  <b>Static evaluation</b> Duration: 02:00 Problem-solving class			
8				<b>Black box exercise</b> Individual work Continuous assessment Not Presential Duration: 02:00
9	<b>Testing</b> Duration: 02:00 Lecture			
10	<b>Testing</b> Duration: 02:00 Problem-solving class			
11				<b>Assignment: testing a software system (part 1)</b> Group work Continuous assessment Not Presential Duration: 10:00
12	<b>Testing: follow-up of assignment</b> Duration: 02:00 Cooperative activities			
13	<b>Testing: follow-up of assignment</b> Duration: 02:00 Cooperative activities			
14				<b>Assignment: testing a software system (part 2)</b> Group work Continuous assessment Not Presential Duration: 10:00
15	<b>Static evaluation: follow-up of assignment</b> Duration: 02:00 Cooperative activities			<b>Static techniques submission</b> Group work Continuous assessment Not Presential Duration: 10:00
16				<b>Static techniques presentation</b> Group work Continuous assessment Presential Duration: 02:00
				<b>Attendance</b> Other assessment Continuous assessment Presential Duration: 00:00  <b>Static techniques exercise resubmission</b> Individual work Final examination Not Presential Duration: 02:00  <b>White box exercise resubmission</b>



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

17				<p>Individual work Final examination Not Presential Duration: 02:00</p> <p><b>Black box exercise resubmission</b> Individual work Final examination Not Presential Duration: 02:00</p> <p><b>Assignment resubmission: testing a software system (part 1)</b> Group work Final examination Not Presential Duration: 10:00</p> <p><b>Assignment resubmission: testing a software system (part 2)</b> Group work Final examination Not Presential Duration: 10:00</p> <p><b>Static techniques presentation (second chance)</b> Group work Final examination Presential Duration: 10:00</p> <p><b>Static techniques resubmission</b> Group work Final examination Presential Duration: 02:00</p>
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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.

\* The schedule is based on an a priori planning of the subject; it might be modified during the academic year, especially considering the COVID19 evolution.



## 7. Activities and assessment criteria

### 7.1. Assessment activities

#### 7.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
3	Static techniques exercise	Individual work	No Presential	02:00	10%	2 / 10	CE8 CE7 CG12
5	White box exercise	Individual work	No Presential	02:00	10%	2 / 10	CG12 CE8 CE7
8	Black box exercise	Individual work	No Presential	02:00	10%	2 / 10	CE8 CE7 CG12
11	Assignment: testing a software system (part 1)	Group work	No Presential	10:00	20%	3 / 10	CE8 CE7 CG4 CG18 CG1 CG19
14	Assignment: testing a software system (part 2)	Group work	No Presential	10:00	20%	3 / 10	CE8 CE7 CG4 CG18 CG1 CG19
15	Static techniques submission	Group work	No Presential	10:00	15%	3 / 10	CE8 CE7 CG4 CG1 CG19
16	Static techniques presentation	Group work	Face-to-face	02:00	5%	5 / 10	CG12 CG18
17	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
17	Static techniques exercise resubmission	Individual work	No Presential	02:00	10%	5 / 10	CE8 CE7 CG12
17	White box exercise resubmission	Individual work	No Presential	02:00	10%	5 / 10	CE8 CE7 CG12
17	Black box exercise resubmission	Individual work	No Presential	02:00	10%	5 / 10	CE8 CE7 CG12
17	Assignment resubmission: testing a software system (part 1)	Group work	No Presential	10:00	20%	5 / 10	CE8 CE7 CG4 CG1 CG19
17	Assignment resubmission: testing a software system (part 2)	Group work	No Presential	10:00	20%	5 / 10	CE8 CE7 CG4 CG1 CG19
17	Static techniques presentation (second chance)	Group work	Face-to-face	10:00	5%	5 / 10	CG12 CG18
17	Static techniques resubmission	Group work	Face-to-face	02:00	15%	5 / 10	CE8 CE7 CG4 CG1 CG19

## 7.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
White box exercise (second resubmission)	Individual work	Face-to-face	02:00	10%	5 / 10	
Static techniques exercise (second resubmission)	Individual work	Face-to-face	02:00	10%	5 / 10	CG12 CE8 CE7
Black box exercise (second resubmission)	Individual work	Face-to-face	02:00	10%	5 / 10	
Assignment second resubmission: testing a software system (part 1)	Group work	Face-to-face	10:00	20%	5 / 10	



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

Assignment second resubmission: testing a software system (part 2)	Group work	Face-to-face	10:00	20%	5 / 10	
Static techniques presentation (third chance)	Group work	Face-to-face	10:00	20%	5 / 10	
Static techniques second resubmission	Group work	Face-to-face	02:00	20%	5 / 10	

## 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:

- Exercises (10% of the score each one):

- Applying a white box technique to a program.
- Applying a black box technique to a program.
- Applying a static technique to a program.

- Assignment performing testing on a software system (40% of the score). This assignment is divided into two parts, submitted separately. Each part counts 20% of the score:

- Testing a software system using a white box technique.
- Testing a software system using a black box technique.

- Assignment about static analysis (20% of the score). This assignment is divided into two parts:

- Doing the task proposed in the assignment (15% of the score).
- Its presentation (5% 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 exercises/assignments that do not reach the minimum score required.
- From those exercises/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 any case exercises/assignments that have a score equal or greater than 5 will be re-submitted.
- 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 exercises/assignments that have been submitted during the progressive evaluation period. It is not possible to submit exercises/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 exercises/assignments that do not reach the minimum score required.
- From those exercises/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 any case exercises/assignments that have a score equal or greater than 5 will be re-submitted.
- 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.



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

## 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	

**7.3.3 Software Quality Management**



INTERNATIONAL  
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EXCELLENCE

COORDINATION PROCESS OF  
LEARNING ACTIVITIES  
PR/CL/001



E.T.S. de Ingenieros  
Informaticos

## ANX-PR/CL/001-01 LEARNING GUIDE

### SUBJECT

**103000487 - Software Quality Management**

### DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

### ACADEMIC YEAR & SEMESTER

2022/23 - Semester 2

INTERNATIONAL  
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COORDINATION PROCESS OF  
LEARNING ACTIVITIESANX-PR/CL/001-01  
LEARNING GUIDEE.T.S. de Ingenieros  
Informáticos

## Index

---

### Learning guide

1. Description.....	1
2. Faculty.....	1
3. Skills and learning outcomes .....	2
4. Brief description of the subject and syllabus.....	4
5. Schedule.....	6
6. Activities and assessment criteria.....	9
7. Teaching resources.....	14



## 1. Description

### 1.1. Subject details

<b>Name of the subject</b>	103000487 - Software Quality Management
<b>No of credits</b>	4 ECTS
<b>Type</b>	Compulsory
<b>Academic year of the programme</b>	First year
<b>Semester of tuition</b>	Semester 2
<b>Tuition period</b>	February-June
<b>Tuition languages</b>	English
<b>Degree programme</b>	10AM - Master Universitario en Ingenieria del Software
<b>Centre</b>	10 - Escuela Tecnica Superior De Ingenieros Informaticos
<b>Academic year</b>	2022-23

## 2. Faculty

### 2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Angelica De Antonio Jimenez (Subject coordinator)	5108	angelica.deantonio@upm.es	M - 10:30 - 12:00 Tu - 17:00 - 18:30 Th - 09:30 - 10:00 Th - 12:00 - 14:30 Previous appointment should be requested at angelica.deantonio@upm.es Check tutoring hours at: <a href="https://doc">https://doc</a>





			s.google.com/spreadsheets/d/1Zi99dtPBXiFFJg4HUSAUelj2M0QijPUeTSmv1FTeNOY/edit?usp=sharing
Jaime Ramirez Rodriguez	5112	jaime.ramirez@upm.es	Sin horario. Previous appointment is recommended. Check tutoring hours at: <a href="https://docs.google.com/spreadsheets/d/1Zi99dtPBXiFFJg4HUSAUelj2M0QijPUeTSmv1FTeNOY/edit?usp=sharing">https://docs.google.com/spreadsheets/d/1Zi99dtPBXiFFJg4HUSAUelj2M0QijPUeTSmv1FTeNOY/edit?usp=sharing</a>

\* 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

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



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

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. Learning outcomes

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

\* 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

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### 4.1. Brief description of the subject

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. Syllabus

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
  - 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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EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

## 5. Schedule

### 5.1. Subject schedule\*

Week	Classroom activities	Laboratory activities	Distant / On-line	Assessment activities
1	<b>Chapter 1.1. Software Quality Definition</b> Duration: 02:00 Lecture			
2	<b>Chapter 1.2 Software Quality Models</b> Duration: 02:00 Lecture			<b>Reading 1 test</b> Online test Continuous assessment Not Presential Duration: 03:00
3	<b>Chapter 1.2 Software Quality Models</b> <b>Chapter 1.3 Usage of a Quality Model</b> Duration: 02:00 Lecture			<b>Analysis of a quality attribute</b> Individual work Continuous assessment Not Presential Duration: 04:00
4	<b>Chapter 1.4 Defects and Defect Density</b> Duration: 02:00 Lecture			<b>Reading 2 test</b> Online test Continuous assessment Not Presential Duration: 03:00
5	<b>Chapter 2.1 Static Controls</b> Duration: 02:00 Lecture			<b>Analysis of a defect tracking tool</b> Group work Continuous assessment Not Presential Duration: 06:00
6		<b>Exercise on inspections</b> Duration: 02:00 Laboratory assignments		<b>Inspection practice</b> Individual work Continuous assessment Presential Duration: 02:00
7		<b>Exercise on walkthroughs</b> Duration: 02:00 Laboratory assignments		<b>Analysis of inspection results</b> Individual work Continuous assessment Not Presential Duration: 02:00
8	<b>Chapter 2.2 Dynamic Controls</b> Duration: 02:00 Lecture			<b>Walkthrough practice and report</b> Group work Continuous assessment Presential Duration: 04:00
9	<b>Chapter 2.2 Dynamic Controls</b> Duration: 02:00 Lecture			<b>Reading 3 test</b> Online test Continuous assessment Not Presential Duration: 03:00



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

10	<b>Chapter 3. Quality Metrics</b> Duration: 01:00 Lecture			<b>First Partial exam</b> Written test Continuous assessment Presential Duration: 01:00
11	<b>Chapter 4. Quality Management</b> Duration: 02:00 Lecture			<b>Reading 4 test</b> Online test Continuous assessment Not Presential Duration: 03:00
12	<b>Chapter 4. Quality Management</b> Duration: 01:00 Lecture  <b>Chapter 5. Quality Assurance</b> Duration: 01:00 Lecture			
13	<b>Chapter 6. Software Configuration Management</b> Duration: 02:00 Lecture			
14	<b>Chapter 6. Software Configuration Management</b> Duration: 02:00 Lecture			<b>Configuration Management exercises</b> Individual work Continuous assessment Not Presential Duration: 04:00
15				<b>Analysis of basic quality management tools</b> Group work Continuous assessment Not Presential Duration: 05:00  <b>Presentation of work on basic quality management tools</b> Group presentation Continuous assessment Presential Duration: 02:00
16				<b>Individual exercises (submitted after the deadline for progressive evaluation, or failed and re-submitted)</b> Individual work Final examination Not Presential Duration: 00:00  <b>Student participation</b> Other assessment Continuous assessment Presential Duration: 00:00  <b>First partial exam (if the grade obtained in progressive evaluation is below the minimum of 4)</b> Written test Final examination Presential Duration: 02:00  <b>Second partial exam</b>



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

				<p>Written test</p> <p>Continuous assessment</p> <p>Presential</p> <p>Duration: 02:00</p> <p><b>Reading tests</b></p> <p>Online test</p> <p>Final examination</p> <p>Not Presential</p> <p>Duration: 12:00</p> <p><b>Group exercises (submitted after the deadline for progressive evaluation, or failed and re-submitted)</b></p> <p>Group work</p> <p>Final examination</p> <p>Not Presential</p> <p>Duration: 00:00</p>
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.

\* The schedule is based on an a priori planning of the subject; it might be modified during the academic year, especially considering the COVID19 evolution.



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

## 6. Activities and assessment criteria

### 6.1. Assessment activities

#### 6.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
2	Reading 1 test	Online test	No Presential	03:00	2.5%	/ 10	CG12
3	Analysis of a quality attribute	Individual work	No Presential	04:00	7%	/ 10	CE7 CG12 CG18
4	Reading 2 test	Online test	No Presential	03:00	2.5%	/ 10	CG12
5	Analysis of a defect tracking tool	Group work	No Presential	06:00	7%	/ 10	CG2 CG3 CG12 CG18 CG1 CE11
6	Inspection practice	Individual work	Face-to-face	02:00	7%	/ 10	CE7 CG1 CE6
7	Analysis of inspection results	Individual work	No Presential	02:00	3%	/ 10	CG2 CG3 CG18 CG1
8	Walkthrough practice and report	Group work	Face-to-face	04:00	8%	/ 10	CE7 CG12 CE1
9	Reading 3 test	Online test	No Presential	03:00	2.5%	/ 10	CG12 CE1
10	First Partial exam	Written test	Face-to-face	01:00	20%	4 / 10	CE6 CE7 CE1
11	Reading 4 test	Online test	No Presential	03:00	2.5%	/ 10	CG12
14	Configuration Management exercises	Individual work	No Presential	04:00	3%	/ 10	CE11
15	Analysis of basic quality management tools	Group work	No Presential	05:00	7%	/ 10	CE1 CG19





15	Presentation of work on basic quality management tools	Group presentation	Face-to-face	02:00	3%	/ 10	CG3 CG18
16	Student participation	Other assessment	Face-to-face	00:00	5%	/ 10	
16	Second partial exam	Written test	Face-to-face	02:00	20%	4 / 10	CE6 CE7 CG12 CG1 CG19 CE1 CE11

**6.1.2. Global examination**

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
16	Individual exercises (submitted after the deadline for progressive evaluation, or failed and re-submitted)	Individual work	No Presential	00:00	13%	/ 10	CG2 CE7 CG3 CG12 CG18 CG1 CG19 CE11
16	First partial exam (if the grade obtained in progressive evaluation is below the minimum of 4)	Written test	Face-to-face	02:00	40%	4 / 10	CE6 CG2 CE7 CG3 CG12 CG1 CG19 CE1 CE11
16	Reading tests	Online test	No Presential	12:00	10%	/ 10	CG12
16	Group exercises (submitted after the deadline for progressive evaluation, or failed and re-submitted)	Group work	No Presential	00:00	14%	/ 10	CG2 CG3 CG12 CG18 CG1 CG19 CE11

**6.1.3. Referred (re-sit) examination**



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Extraordinary evaluation exam	Written test	Face-to-face	02:00	40%	4 / 10	CE6 CE7 CG12 CE1 CE11
Reading tests	Online test	Face-to-face	12:00	10%	/ 10	CG12
Group exercises (grade obtained in ordinary evaluation, or new submission - see conditions for submission)	Group work	Face-to-face	00:00	25%	/ 10	CG2 CG3 CG12 CG18 CG1 CG19 CE11
Individual exercises (grade obtained in ordinary evaluation, or new submission - see conditions for submission)	Individual work	Face-to-face	00:00	20%	/ 10	CE7 CG3 CG2 CG12 CG18 CG1 CG19
Student participation (grade obtained in progressive evaluation)	Other assessment	Face-to-face	00:00	5%	/ 10	

## 6.2. Assessment criteria

### 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)	-
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

INTERNATIONAL  
CAMPUS OF  
EXCELLENCEPR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIESANX-PR/CL/001-01  
LEARNING GUIDEE.T.S. de Ingenieros  
Informáticos

### 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. 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.



## 7. Teaching resources

### 7.1. Teaching resources for the subject

Name	Type	Notes
Schulmeyer, 2007	Bibliography	Gordon Schulmeyer, G. (2007) Handbook of Software Quality Assurance, Artech House Publishers, 4th ed.
Fagan, 1976	Bibliography	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	Bibliography	D. Galin (2003) Software Quality Assurance: From Theory to Implementation, Addison-Wesley
McCall, 1977	Bibliography	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	Bibliography	C.A. Cianfrani, J.J. Tsiakals, J.E. West (2009) ISO 9001:2008 Explained, ASQ Quality Press
ISO/IEC 9126-1:2001	Bibliography	ISO/IEC 9126-1:2001, Software engineering -- Product quality -- Part 1: Quality model
ISO/IEC TR 9126-2:2003	Bibliography	ISO/IEC TR 9126-2:2003, Software engineering -- Product quality -- Part 2: External metrics
ISO/IEC TR 9126-3:2003	Bibliography	ISO/IEC TR 9126-3:2003, Software engineering -- Product quality -- Part 3: Internal metrics
ISO/IEC TR 9126-4:2004	Bibliography	ISO/IEC TR 9126-4:2004, Software engineering -- Product quality -- Part 4: Quality in use metrics



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

IEEE 983-86	Bibliography	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	Bibliography	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	Web resource	<a href="http://videos.asq.org/the-how-and-why-of-auditing">http://videos.asq.org/the-how-and-why-of-auditing</a>
Guidelines for the Application of ISO 9001:2000 to Computer Software	Bibliography	IEEE Guide Adoption of ISO/IEC 90003:2004 Software Engineering -Guidelines for the Application of ISO 9001:2000 to Computer Software
Subject web site	Web resource	<a href="https://moodle.upm.es/titulaciones/oficiales/course/view.php?id=2999">https://moodle.upm.es/titulaciones/oficiales/course/view.php?id=2999</a>

**7.4 Advanced Software Engineering Aspects Module**

**7.4.1 Agile Software Development: Agile Practices and Agile Usability**



INTERNATIONAL  
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COORDINATION PROCESS OF  
LEARNING ACTIVITIES  
PR/CL/001



E.T.S. de Ingenieros  
Informáticos

## ANX-PR/CL/001-01 LEARNING GUIDE

### SUBJECT

**103000545 - Agile Software Development: Agile Practices And Agile Usability**

### DEGREE PROGRAMME

10AM - Master Universitario En Ingeniería Del Software

### ACADEMIC YEAR & SEMESTER

2022/23 - Semester 1



INTERNATIONAL  
CAMPUS OF  
EXCELLENCEPR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIESANX-PR/CL/001-01  
LEARNING GUIDEE.T.S. de Ingenieros  
Informáticos

## Index

---

### Learning guide

1. Description.....	1
2. Faculty.....	1
3. Skills and learning outcomes .....	2
4. Brief description of the subject and syllabus.....	3
5. Schedule.....	4
6. Activities and assessment criteria.....	6
7. Teaching resources.....	8



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



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## 1. Description

### 1.1. Subject details

<b>Name of the subject</b>	103000545 - Agile Software Development: Agile Practices And Agile Usability
<b>No of credits</b>	4 ECTS
<b>Type</b>	Optional
<b>Academic year of the programme</b>	First year
<b>Semester of tuition</b>	Semester 1
<b>Tuition period</b>	September-January
<b>Tuition languages</b>	English
<b>Degree programme</b>	10AM - Master Universitario en Ingeniería del Software
<b>Centre</b>	10 - Escuela Tecnica Superior De Ingenieros Informaticos
<b>Academic year</b>	2022-23

## 2. Faculty

### 2.1. Faculty members with subject teaching role

<b>Name and surname</b>	<b>Office/Room</b>	<b>Email</b>	<b>Tutoring hours *</b>
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 \*

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#### 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

RA26 - Group work skill SC13, SC14, CG17 A

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

RA24 - Conflict solving capability SC13, SC14, CG18 C

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

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### 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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ANX-PR/CL/001-01  
LEARNING GUIDE



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## 5. Schedule

### 5.1. Subject schedule\*

Week	Classroom activities	Laboratory activities	Distant / On-line	Assessment activities
1	<b>Unit 1. Agile Fundamentals</b> Duration: 02:00 Cooperative activities			
2	<b>Unit 2. Agile Artifacts</b> Duration: 02:00 Cooperative activities			
3	<b>Unit 3. Description of Agile Methods</b> Duration: 02:00 Cooperative activities			
4	<b>Unit 3. Description of Agile Methods (Serious Game)</b> Duration: 02:00 Cooperative activities			
5	<b>Unit 3. Description of Agile Methods</b> Duration: 02:00 Cooperative activities			
6	<b>Unit 4. Agile Usability - Lean UX</b> Duration: 02:00 Cooperative activities			
7	<b>Unit 4. Agile Usability - Lean UX</b> Duration: 02:00 Cooperative activities			
8	<b>Unit 4. Agile Usability</b> Duration: 02:00 Cooperative activities			
9	<b>Unit 4. Agile Usability</b> Duration: 02:00 Cooperative activities			
10	<b>Unit 4. Agile Usability</b> Duration: 02:00 Cooperative activities			
11	<b>Unit 5. Agile UX Project</b> Duration: 02:00 Cooperative activities			
12	<b>Unit 5. Agile UX Project</b> Duration: 02:00 Cooperative activities			<b>Presentation of Project</b> Group presentation Continuous assessment Presential Duration: 00:30
13	<b>Unit 5. Agile UX Project</b> Duration: 02:00 Cooperative activities			<b>Presentation of Project</b> Group presentation Continuous assessment Presential Duration: 02:00



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PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

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

\* The schedule is based on an a priori planning of the subject; it might be modified during the academic year, especially considering the COVID19 evolution.



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PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

## 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	00:30	10%	0 / 10	CG9 CG3 CG18 CE13
13	Presentation of Project	Group presentation	Face-to-face	02:00	10%	0 / 10	CG18 CE13 CG9 CG3
14	Presentation of Project	Group presentation	Face-to-face	02:00	10%	0 / 10	CG9 CG3 CG18 CE13
15	Presentation of Project	Group presentation	Face-to-face	02:00	10%	0 / 10	CG9 CG3 CG18 CE13
15	Active Participation of Students	Other assessment	No Presential	00:00	10%	0 / 10	
15	Content of Project Report	Group work	Face-to-face	02:00	50%	5 / 10	CG3 CG18 CE13 CG9

#### 6.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
17	Content of the Project Report	Individual work	No Presential	00:00	50%	5 / 10	CG3 CG18 CE13 CG9
17	Presentation of Project	Individual presentation	Face-to-face	02:00	40%	0 / 10	

#### 6.1.3. Referred (re-sit) examination



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PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Presentation of Project Report	Individual presentation	Face-to-face	00:30	90%	5 / 10	CG9 CG3 CG18 CE13
Active Participation of Students	Other assessment	Face-to-face	00:00	10%	0 / 10	CG9 CG3 CG18 CE13

## 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 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 (over 10) as final grade in order to pass the matter.

## 7. Teaching resources

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### 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	<a href="http://scrumtraininginstitute.com/library">http://scrumtraininginstitute.com/library</a>
Process Agility and Software Usability	Web resource	<a href="http://citeseer.ist.psu.edu/465732.html">http://citeseer.ist.psu.edu/465732.html</a>
Agile Ecosystems	Bibliography	J. Hightsmith. Agile Software Development Ecosystems. Addison-Wesley, 2005
Lean UX. Designing great products with agile teams	Bibliography	Book by Lean UX authors

#### **7.4.2 Challenges for Accessible Computing for People with Functional Diversity**



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LEARNING ACTIVITIES  
PR/CL/001



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Informaticos

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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

2022/23 - Semester 1



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PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

## Index

---

### Learning guide

1. Description.....	1
2. Faculty.....	1
3. Skills and learning outcomes .....	2
4. Brief description of the subject and syllabus.....	3
5. Schedule.....	5
6. Activities and assessment criteria.....	9
7. Teaching resources.....	12
8. Other information.....	13



## 1. Description

### 1.1. Subject details

<b>Name of the subject</b>	103000603 - Challenges For Accessible Computing For People With Functional Diversity
<b>No of credits</b>	4 ECTS
<b>Type</b>	Optional
<b>Academic year of the programme</b>	First year
<b>Semester of tuition</b>	Semester 1
<b>Tuition period</b>	September-January
<b>Tuition languages</b>	English
<b>Degree programme</b>	10AM - Master Universitario en Ingeniería del Software
<b>Centre</b>	10 - Escuela Tecnica Superior De Ingenieros Informaticos
<b>Academic year</b>	2022-23

## 2. Faculty

### 2.1. Faculty members with subject teaching role

<b>Name and surname</b>	<b>Office/Room</b>	<b>Email</b>	<b>Tutoring hours *</b>
M. Carmen Suarez De Figueroa Baonza	D-2201	mdelcarmen.suarezdefigueroa@upm.es	M - 10:00 - 12:00 M - 14:00 - 15:00 F - 12:00 - 15:00
Loic Antonio Martinez Normand	D3352	loic.mnormand@upm.es	Tu - 13:00 - 15:00 Th - 13:00 - 15:00 F - 13:00 - 15:00 Please confirm appointment via email



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PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

Jose Luis Fuertes Castro (Subject coordinator)	D4307	jose Luis.fuertes@upm.es	Tu - 17:00 - 20:00 W - 12:00 - 15:00
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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.

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

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### 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 will start with an introduction to basic ICT accessibility concepts: functional diversity, design for all, standards and the assessment of the accessibility degree of ICT products and services.

After that, the students will work on current challenges in the field, such as:

- Methods, techniques and tools for accessibility evaluation
- Applying user centred design and design for all in development methodologies
- New ICT accessibility standards
- Cognitive Accessibility

### 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



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PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



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Informáticos

#### 4. Cognitive Accessibility

##### 4.1. Introduction to the Easy-to-Read Methodology





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LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



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Informáticos

## 5. Schedule

### 5.1. Subject schedule\*

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



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EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

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



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PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

12	<b>Chapter 4: Cognitive Accessibility</b> Duration: 01:45 Lecture			<b>Cognitive accessibility evaluation</b> Other assessment Continuous assessment Presential Duration: 00:15
13				
14				<b>Presentation of exercise 3</b> Group presentation Continuous assessment and final examination Presential Duration: 02:00
15				<b>Delivery of exercise 4</b> Group presentation Continuous assessment Not Presential Duration: 00:00  <b>Presentation of exercise 3</b> Group presentation Continuous assessment and final examination Presential Duration: 02:00
16				<b>Delivery of exercise 3</b> Group work Continuous assessment Not Presential Duration: 00:00
17				<b>Test 1</b> Written test Final examination Not Presential Duration: 00:30  <b>Test 2</b> Written test Continuous assessment and final examination Not Presential Duration: 00:30  <b>Delivery of exercise 1</b> Group work Final examination Not Presential Duration: 00:00  <b>Delivery of exercise 2</b> Group work Final examination Not Presential Duration: 00:00  <b>Delivery of exercise 3</b> Group work Final examination Not Presential Duration: 00:00  <b>Delivery of exercise 4</b> Group presentation



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PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
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Informáticos

				Final examination Presential Duration: 00:00
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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.

\* The schedule is based on an a priori planning of the subject; it might be modified during the academic year, especially considering the COVID19 evolution.



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LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

## 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
8	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	CG13 CE14 CE13
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	Presentation of exercise 3	Group presentation	Face-to-face	02:00	5%	/ 10	CE13 CG13 CE14



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PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

15	Delivery of exercise 4	Group presentation	No Presential	00:00	10%	/ 10	CG13
15	Presentation of exercise 3	Group presentation	Face-to-face	02:00	5%	/ 10	CE13 CG13 CE14
16	Delivery of exercise 3	Group work	No Presential	00:00	10%	/ 10	CG13
17	Test 2	Written test	No Presential	00:30	10%	/ 10	CG13 CE14

### 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 CG13 CE14
15	Presentation of exercise 3	Group presentation	Face-to-face	02:00	5%	/ 10	CE13 CG13 CE14
17	Test 1	Written test	No Presential	00:30	10%	/ 10	CE13
17	Test 2	Written test	No Presential	00:30	10%	/ 10	CG13 CE14
17	Delivery of exercise 1	Group work	No Presential	00:00	10%	/ 10	CE14
17	Delivery of exercise 2	Group work	No Presential	00:00	20%	/ 10	CE14
17	Delivery of exercise 3	Group work	No Presential	00:00	15%	/ 10	CG13 CE14 CE13
17	Delivery of exercise 4	Group presentation	Face-to-face	00:00	15%	/ 10	CG13

### 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	CG13 CE14
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



Delivery of exercise 3	Individual work	Face-to-face	00:00	20%	/ 10	CG13 CE14 CE13
Presentation of exercise 3	Individual presentation	Face-to-face	02:00	10%	/ 10	CG13 CE14 CE13
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 are not recoverable); there will be also short in-class evaluations during the semester

### 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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PR/CL/001  
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LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



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Informáticos

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 (July)*

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. <a href="http://www.ncsu.edu/ncsu/design/cud/about_ud/udprinciples.htm">http://www.ncsu.edu/ncsu/design/cud/about_ud/udprinciples.htm</a>





INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

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 <a href="http://jtc1access.org/TR29138.htm">http://jtc1access.org/TR29138.htm</a> )
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: <a href="http://www.sidar.org">http://www.sidar.org</a> , España
Accessibility Requirements for ICT products and services. V3.2.1. March 2021	Bibliography	EN 301 549. <a href="https://www.etsi.org/deliver/etsi_en/301500_301599/301549/03.02.01_60/en_301549v030201p.pdf">https://www.etsi.org/deliver/etsi_en/301500_301599/301549/03.02.01_60/en_301549v030201p.pdf</a>

## 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. 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 the relationship between the SDGs and accessibility, this course is related to the following sustainable development

INTERNATIONAL  
CAMPUS OF  
EXCELLENCEPR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIESANX-PR/CL/001-01  
LEARNING GUIDEE.T.S. de Ingenieros  
Informáticos

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.

**7.4.3 Critical Software**



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

COORDINATION PROCESS OF  
LEARNING ACTIVITIES  
PR/CL/001



E.T.S. de Ingenieros  
Informaticos

## ANX-PR/CL/001-01 LEARNING GUIDE

### SUBJECT

**103000540 - Critical Software**

### DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

### ACADEMIC YEAR & SEMESTER

2022/23 - Semester 1

INTERNATIONAL  
CAMPUS OF  
EXCELLENCEPR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIESANX-PR/CL/001-01  
LEARNING GUIDEE.T.S. de Ingenieros  
Informáticos

## Index

---

### Learning guide

1. Description.....	1
2. Faculty.....	1
3. Skills and learning outcomes .....	2
4. Brief description of the subject and syllabus.....	3
5. Schedule.....	4
6. Activities and assessment criteria.....	6
7. Teaching resources.....	8
8. Other information.....	8



## 1. Description

### 1.1. Subject details

<b>Name of the subject</b>	103000540 - Critical Software
<b>No of credits</b>	4 ECTS
<b>Type</b>	Optional
<b>Academic year of the programme</b>	First year
<b>Semester of tuition</b>	Semester 1
<b>Tuition period</b>	September-January
<b>Tuition languages</b>	English
<b>Degree programme</b>	10AM - Master Universitario en Ingeniería del Software
<b>Centre</b>	10 - Escuela Técnica Superior De Ingenieros Informáticos
<b>Academic year</b>	2022-23

## 2. Faculty

### 2.1. Faculty members with subject teaching role

<b>Name and surname</b>	<b>Office/Room</b>	<b>Email</b>	<b>Tutoring hours *</b>
Tomas San Feliu Gilabert	5106	tomas.sanfeliu@upm.es	Tu - 10:00 - 13:00 Th - 10:00 - 13:00
Andres Silva Vazquez (Subject coordinator)	5107	andres.silva@upm.es	Tu - 11:00 - 14:00 Th - 11:00 - 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 \*

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#### 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.

#### 3.2. Learning outcomes

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.

RA17 - Given a specific software engineering field, the student assesses and designs the most appropriate solution to solve some of its problems, presenting the technical difficulties and applicability limitations.

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.

\* 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

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### 4.1. Brief description of the subject

The subject provides an introduction to the main concepts and, specially, to the mindset needed for understanding and managing the hazardous behaviours related to complex software systems.

### 4.2. Syllabus

1. Safeware concepts
  - 1.1. Normal Accidents theory
  - 1.2. Basic Concepts
  - 1.3. Reliability vs. Safety
  - 1.4. Hazard & Risk Analysis
  - 1.5. Common Techniques
2. Design and Safeware
  - 2.1. Hazard elimination
  - 2.2. Hazard reduction
  - 2.3. Hazard control
  - 2.4. Examples
3. Concepts from the IEC61508 Standard
  - 3.1. Introduction to IEC61508
  - 3.2. Concepts: SIL, functional safety, etc.
  - 3.3. Hazard log
  - 3.4. Limits of IEC61508
4. Human and Organizational Factors
  - 4.1. Performance models
  - 4.2. Human error
  - 4.3. Organizational problems
  - 4.4. Solution proposals





INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

## 5. Schedule

### 5.1. Subject schedule\*

Week	Classroom activities	Laboratory activities	Distant / On-line	Assessment activities
1	Lecture/workshop on topics 1.1 and 1.2 Duration: 02:00 Cooperative activities			
2	Lecture/workshop on topic 1.3 Duration: 02:00 Cooperative activities			Elaboration of the presentation and draft of the expository writing Group presentation Continuous assessment Not Presential Duration: 04:00
3	Lecture/workshop on topic 1.4 Duration: 02:00 Cooperative activities			
4	Lecture/workshop on topic 1.5 Duration: 02:00 Cooperative activities			Elaboration of the presentation and draft of the expository writing Group presentation Continuous assessment Not Presential Duration: 04:00
5	Lecture/workshop on topic 2.1 Duration: 02:00 Cooperative activities			
6	Lecture/workshop on topic 2.2 Duration: 02:00 Cooperative activities			Elaboration of the presentation and draft of the expository writing Group presentation Continuous assessment Not Presential Duration: 04:00
7	Lecture/workshop on topic 2.3 Duration: 02:00 Cooperative activities			
8	Lecture/workshop on topic 2.4 Duration: 02:00 Cooperative activities			Elaboration of the presentation and draft of the expository writing Group presentation Continuous assessment Not Presential Duration: 04:00
9	Lecture/workshop on topic 3.1 Duration: 02:00 Cooperative activities			
10	Lecture/workshop on topic 3.2 Duration: 02:00 Cooperative activities			Elaboration of the presentation and draft of the expository writing Group presentation Continuous assessment Not Presential Duration: 04:00



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

11	Lecture/workshop on topic 3.3 Duration: 02:00 Cooperative activities			
12	Lecture/workshop on topic 3.4 Duration: 02:00 Cooperative activities			Elaboration of the presentation and draft of the expository writing Group presentation Continuous assessment Not Presential Duration: 04:00
13	Lecture/workshop on topic 4.1 Duration: 02:00 Cooperative activities			
14	Lecture/workshop on topics 4.2 Duration: 02:00 Cooperative activities			Elaboration of the presentation and draft of the expository writing Group presentation Continuous assessment Not Presential Duration: 04:00
15	Lecture/workshop on topics 4.3 and 4.4 Duration: 02:00 Cooperative activities			Final expositions and overall conclusions. Group presentation Continuous assessment Not Presential Duration: 04:00
16				
17				Final examination for those students with an average inferior to 5. Written test Final examination Presential Duration: 05:00

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.

\* The schedule is based on an a priori planning of the subject; it might be modified during the academic year, especially considering the COVID19 evolution.



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

## 6. Activities and assessment criteria

### 6.1. Assessment activities

#### 6.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
2	Elaboration of the presentation and draft of the expository writing	Group presentation	No Presential	04:00	20%	3 / 10	CE13 CE14
4	Elaboration of the presentation and draft of the expository writing	Group presentation	No Presential	04:00	20%	3 / 10	CE13 CE14
6	Elaboration of the presentation and draft of the expository writing	Group presentation	No Presential	04:00	10%	3 / 10	CE13 CE14
8	Elaboration of the presentation and draft of the expository writing	Group presentation	No Presential	04:00	10%	3 / 10	CE13 CE14
10	Elaboration of the presentation and draft of the expository writing	Group presentation	No Presential	04:00	10%	3 / 10	CE13 CE14
12	Elaboration of the presentation and draft of the expository writing	Group presentation	No Presential	04:00	10%	3 / 10	CE13 CE14
14	Elaboration of the presentation and draft of the expository writing	Group presentation	No Presential	04:00	10%	3 / 10	CE13 CE14
15	Final expositions and overall conclusions.	Group presentation	No Presential	04:00	10%	3 / 10	CE14 CE13

#### 6.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
17	Final examination for those students with an average inferior to 5.	Written test	Face-to-face	05:00	100%	5 / 10	CE13 CE14

#### 6.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Examen final	Written test	Face-to-face	05:00	100%	5 / 10	CE13 CE14



## 6.2. Assessment criteria

The grading criteria for this subject are closely linked to the working methods. This method will be concept-oriented. For each topic and subtopic there will be a lecture/workshop in the classroom, and the teacher will choose a key concept. Later, the students, preferably in groups, will have one week for reading concept-related bibliography and elaborate a presentation and an expository writing (8 pages max.).

Each group of students will present a draft of their work in the classroom, which may be evaluated (anonymously) by the other students. The rhythm of work will be, approximately, as follows: every two weeks, each group of students will submit the expository writing of past week's concept. In parallel, the students will attend the lectures/workshops that will be done in the classroom, and possibly qualify them.

With more detail, the following two-week procedure will be followed for each concept:

1. The teacher will provide an introduction to a concept, relevant bibliography and documentation for the concept at hand. Such documentation will be a starting point for the student, who will explore other relevant sources of information.
2. Each group of students will elaborate a presentation related to the concept. In parallel, they should start elaborating a draft document with the expository writing of the concept.
3. The following week, in the classroom, the concept will be presented, the mistakes and problems detected in the presentation will be discussed and a consensus will be achieved. The rest of the students in the classroom may evaluate the presentations.
4. The final expository writing (8 pages max.) will be uploaded to Moodle.

The concepts of the course are listed below, but they could be dynamically modified, along the course. For some topics the teacher will provide problems for being solved by the group: Hazard. Reliability vs. Safety. Risk. SafeWare and associated techniques. Concepts from the Std. IEC 61508: SIL, ALARP. Automation and Overautomation. Norman's Model. Latent errors and violations. Models: STAMP (Leveson), ChiDeltas (Hall-Silva). Other concepts to be announced.

The mechanics of the course will be as follows:

- The communication among the students and the teacher will be done through Moodle. The steps to be done at each point during the course will be announced always through Moodle.
- Problem resolution and clarification of student's questions will be done also through Moodle.
- The documentation for each concept will be provided on demand, via Moodle.
- The purpose of evaluating the presentations by other students is to get an idea on how clear the concept has been explained. Of course, those qualifications are just informative for the teacher, who will have a final



decision on the overall evaluation.

The final qualification will be an average of the teacher's qualifications for each submitted work, taking into account also the effort and overall attitude of each group of students.

## 7. Teaching resources

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### 7.1. Teaching resources for the subject

Name	Type	Notes
Bibliografía	Bibliography	Bibliografía available in: <a href="https://www.mendeley.com/community/critical-sw">https://www.mendeley.com/community/critical-sw</a>

## 8. Other information

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### 8.1. Other information about the subject

The scheduled chronogram follows an ideal situation and it may suffer some changes due to future emergent situations, like it happened in the past due to COVID-19.

**7.4.4 Data Engineering**



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

COORDINATION PROCESS OF  
LEARNING ACTIVITIES  
PR/CL/001



E.T.S. de Ingenieros  
Informaticos

# ANX-PR/CL/001-01 LEARNING GUIDE

## SUBJECT

**103000541 - Data Mining**

## DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

## ACADEMIC YEAR & SEMESTER

2022/23 - Semester 1



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

## Index

---

### Learning guide

1. Description.....	1
2. Faculty.....	1
3. Prior knowledge recommended to take the subject.....	2
4. Skills and learning outcomes .....	2
5. Brief description of the subject and syllabus.....	3
6. Schedule.....	5
7. Activities and assessment criteria.....	7
8. Teaching resources.....	9





## 1. Description

### 1.1. Subject details

<b>Name of the subject</b>	103000541 - Data Mining
<b>No of credits</b>	4 ECTS
<b>Type</b>	Optional
<b>Academic year of the programme</b>	First year
<b>Semester of tuition</b>	Semester 1
<b>Tuition period</b>	September-January
<b>Tuition languages</b>	English
<b>Degree programme</b>	10AM - Master Universitario en Ingenieria del Software
<b>Centre</b>	10 - Escuela Tecnica Superior De Ingenieros Informaticos
<b>Academic year</b>	2022-23

## 2. Faculty

### 2.1. Faculty members with subject teaching role

<b>Name and surname</b>	<b>Office/Room</b>	<b>Email</b>	<b>Tutoring hours *</b>
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

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#### 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 \*

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#### 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

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

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

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

RA86 - Being able to understand the data science's implications for management and decision making in a data-rich environment.

\* 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

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### 5.1. Brief description of the subject

The course is mainly dedicated to the improvement of the development of software engineering projects by means of Data Mining.

The course is very interactive, with the development of many short projects and exposition at class. Learning by doing, using the IBM SPSS tool

Topics:

Data Engineering, Data Mining, Business Intelligence

Descriptive, Diagnostic, Predictive and Prescriptive Analysis of data

Techniques:

- Classification

- Regression



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

- Association

- Clustering

## 5.2. Syllabus

1. INTRODUCTION TO DATA ENGINEERING
2. THE TOOL: IBM SPSS MODELER
3. Descriptive, Diagnostic, Predictive and Prescriptive Analysis
4. RFM ANALYSIS
5. CLUSTERING
6. LINER REGRESSION
7. LOGISTIC REGRESSION
8. NEAREST NEIGHBOR
9. DECISION TREES
10. NEURAL NETWORKS
11. ENSEMBLE METHODS
12. ASSOCIATION RULES
13. DEALING WITH TIME



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

## 6. Schedule

### 6.1. Subject schedule\*

Week	Classroom activities	Laboratory activities	Distant / On-line	Assessment activities
1	<b>INTRODUCTION TO DATA ANALYTICS</b> Duration: 02:00 Additional activities			
2				<b>Supermarket Assignment</b> Individual work Continuous assessment Presential Duration: 02:00
3	<b>IBM SPSS: INTRO AND PRACTICE</b> Duration: 02:00 Problem-solving class			
4				<b>IBM SPSS EXERCICES</b> Individual work Continuous assessment Presential Duration: 02:00
5	<b>A PRACTICAL SESSION ON DESCRIPTIVE ANALYSIS</b> Duration: 01:00 Problem-solving class			<b>Descriptive Analysis Questions</b> Individual work Continuous assessment Presential Duration: 01:00
6	<b>Some Data Visualization Tools of IBM SPSS</b> Duration: 01:00 Lecture			<b>Visual Descriptive Analysis of Supermarket data</b> Individual work Continuous assessment Presential Duration: 01:00
7	<b>DESCRIPTIVE ANALYSIS: RFM</b> Duration: 01:00 Lecture			<b>Segmentation of supermarket customers</b> Individual work Continuous assessment Presential Duration: 01:00
8	<b>DESCRIPTIVE ANALYSIS: CLUSTERING</b> Duration: 01:00 Lecture			<b>Clustering of Supermarket Customers</b> Individual work Continuous assessment Presential Duration: 01:00
9	<b>DIAGNOSTIC ANALYTICS: CORRELATION, ANOVA AND CHI-SQUARED TESTS</b> Duration: 01:00 Lecture			<b>Titanic Survival</b> Individual work Continuous assessment Presential Duration: 01:00  <b>Basket Analysis</b> Individual work Continuous assessment Presential Duration: 01:00



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

10	<b>LINEAR REGRESSION</b> Duration: 01:00 Lecture			<b>Predicting purchases</b> Individual work Continuous assessment Presential Duration: 01:00
11	<b>LOGISTIC REGRESSION</b> Duration: 01:00 Lecture			<b>Touchpoints</b> Individual work Continuous assessment Presential Duration: 01:00
12	<b>DECISION TREES</b> Duration: 01:00 Lecture  <b>Instance-Based Classifiers: NEAREST NEIGHBOR</b> Duration: 01:00 Lecture			
13	<b>NEURAL NETWORKS</b> Duration: 01:00 Lecture  <b>ENSEMBLE METHODS</b> Duration: 01:00 Lecture			
14				<b>Competition: Predictive Analysis</b> Individual work Continuous assessment Presential Duration: 04:00
15	<b>ASSOCIATION RULES</b> Duration: 01:00 Lecture  <b>DEALING WITH TIME</b> Duration: 01:00 Lecture			
16				<b>Competition: Predictive Analysis</b> Individual work Continuous assessment Presential Duration: 04:00
17				<b>ALL ASSIGNMENTS</b> Individual work Final 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.

\* The schedule is based on an a priori planning of the subject; it might be modified during the academic year, especially considering the COVID19 evolution.



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

## 7. Activities and assessment criteria

### 7.1. Assessment activities

#### 7.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
2	Supermarket Assignment	Individual work	Face-to-face	02:00	5%	5 / 10	CG18 CG8 CG9
4	IBM SPSS EXERCICES	Individual work	Face-to-face	02:00	5%	5 / 10	CG14
5	Descriptive Analysis Questions	Individual work	Face-to-face	01:00	5%	5 / 10	CG18 CG9
6	Visual Descriptive Analysis of Supermarket data	Individual work	Face-to-face	01:00	5%	5 / 10	CG18 CG9
7	Segmentation of supermarket customers	Individual work	Face-to-face	01:00	10%	5 / 10	CG18 CG14 CG8 CG9 CG3
8	Clustering of Supermarket Customers	Individual work	Face-to-face	01:00	10%	5 / 10	CG18 CG14 CG8 CG9 CG3
9	Titanic Survival	Individual work	Face-to-face	01:00	10%	5 / 10	CG18 CG14 CG8 CG9 CG3
9	Basket Analysis	Individual work	Face-to-face	01:00	10%	5 / 10	CG18 CG14 CG8 CG9 CG3
10	Predicting purchases	Individual work	Face-to-face	01:00	10%	5 / 10	CG18 CG14 CG8 CG9 CG3



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

11	Touchpoints	Individual work	Face-to-face	01:00	10%	5 / 10	CG18 CG14 CG8 CG9 CG3
14	Competition: Predictive Analysis	Individual work	Face-to-face	04:00	10%	5 / 10	CG18 CG14 CG8 CG9 CG3
16	Competition: Predictive Analysis	Individual work	Face-to-face	04:00	10%	5 / 10	CG18 CG14 CG8 CG9 CG3

#### 7.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
17	ALL ASSIGNMENTS	Individual work	Face-to-face	02:00	100%	5 / 10	CG18 CG14 CG8 CG9 CG3

#### 7.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
ALL ASSIGNMENTS	Individual presentation	Face-to-face	02:02	100%	5 / 10	CG18 CG14 CG8 CG9 CG3





## 7.2. Assessment criteria

The evaluation is based on the assignments. All assignments are mandatory for all three types of examinations.

For the continuous or progressive evaluation, it is allowed one resubmission for each assignment.

For the global evaluation, you can only submit once each assignment.

For the extraordinary evaluation, only failed assignments submitted in the continuous or global examinations can be resubmitted.

## 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



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informaticos

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	Others	THE TOOL WE WILL USE
Sala de trabajo en grupo con ordenadores	Equipment	
aula	Equipment	

**7.4.5 Management, Relationships and Communication in Working Groups**



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CAMPUS OF  
EXCELLENCE

COORDINATION PROCESS OF  
LEARNING ACTIVITIES  
PR/CL/001



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Informaticos

## ANX-PR/CL/001-01 LEARNING GUIDE

### SUBJECT

**103000544 - Management, Relationships And Communication In Working Groups**

### DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

### ACADEMIC YEAR & SEMESTER

2022/23 - Semester 1

INTERNATIONAL  
CAMPUS OF  
EXCELLENCEPR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIESANX-PR/CL/001-01  
LEARNING GUIDEE.T.S. de Ingenieros  
Informáticos

## Index

---

### Learning guide

1. Description.....	1
2. Faculty.....	1
3. Prior knowledge recommended to take the subject.....	2
4. Skills and learning outcomes .....	3
5. Brief description of the subject and syllabus.....	4
6. Schedule.....	6
7. Activities and assessment criteria.....	9
8. Teaching resources.....	12
9. Other information.....	12



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

## 1. Description

### 1.1. Subject details

<b>Name of the subject</b>	103000544 - Management, Relationships And Communication In Working Groups
<b>No of credits</b>	4 ECTS
<b>Type</b>	Optional
<b>Academic year of the programme</b>	First year
<b>Semester of tuition</b>	Semester 1
<b>Tuition period</b>	September-January
<b>Tuition languages</b>	English
<b>Degree programme</b>	10AM - Master Universitario en Ingeniería del Software
<b>Centre</b>	10 - Escuela Técnica Superior De Ingenieros Informáticos
<b>Academic year</b>	2022-23

## 2. Faculty

### 2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Susana Muñoz Hernandez (Subject coordinator)	D2310	susana.munoz@upm.es	Tu - 14:00 - 16:00 Th - 10:00 - 12:00 F - 12:00 - 14:00 To arrange an appointment it is mandatory to send an email in advance to susana@fi.upm.es.



Santiago Eibe Garcia	D2311	santiago.eibe@upm.es	M - 12:00 - 13:30 M - 15:30 - 17:00 W - 15:00 - 16:30 Th - 15:30 - 17:00 To arrange an appointment it is mandatory to send an email in advance to susana@fi.upm.es or to seibe@fi.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 \*

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### 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

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### 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.).

### 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



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

- 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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CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

## 6. Schedule

### 6.1. Subject schedule\*

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



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

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



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

15				<b>Work and Presentation evaluation</b> Individual work Continuous assessment Presential Duration: 01:00
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.

\* The schedule is based on an a priori planning of the subject; it might be modified during the academic year, especially considering the COVID19 evolution.



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

## 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	01:00	5%	0 / 10	CG3 CG18 CE13
2	Participation in class discussions Topic selection	Individual presentation	Face-to-face	01:00	5%	0 / 10	CG3 CG18 CE13
3	Participation in class discussions Topic selection	Individual presentation	Face-to-face	01:00	5%	0 / 10	CG3 CG18 CE13
4	Participation in class discussions Topic selection	Individual presentation	Face-to-face	01:00	5%	0 / 10	CG3 CG18 CE13
5	Participation in class discussions Topic selection	Individual presentation	Face-to-face	01:00	5%	0 / 10	CG3 CG18 CE13
6	Participation in class discussions Topic selection	Individual presentation	Face-to-face	01:00	5%	0 / 10	CG3 CG18 CE13
7	Participation in class discussions Topic selection	Individual presentation	Face-to-face	01:00	5%	0 / 10	CG3 CG18 CE13
8	Participation in class discussions Topic selection	Individual presentation	Face-to-face	01:00	5%	0 / 10	CG3 CG18 CE13
9	Participation in class discussions Topic selection	Individual presentation	Face-to-face	01:00	5%	0 / 10	CG3 CG18 CE13
10	Participation in class discussions Topic selection	Individual presentation	Face-to-face	01:00	5%	0 / 10	CG3 CG18 CE13
11	Participation in class discussions Topic selection	Individual presentation	Face-to-face	01:00	5%	0 / 10	CG3 CG18 CE13



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

12	Participation in class discussions Topic selection	Individual presentation	Face-to-face	01:00	5%	0 / 10	CG3 CG18 CE13
13	Participation in class discussions Topic selection	Individual presentation	Face-to-face	01:00	5%	0 / 10	CG3 CG18 CE13
14	Participation in class discussions Topic selection	Individual presentation	Face-to-face	01:00	5%	0 / 10	CG3 CG18 CE13
15	Work and Presentation evaluation	Individual work	Face-to-face	01:00	30%	0 / 10	CG3 CG18 CE13

#### 7.1.2. Global examination

No se ha definido la evaluación sólo por prueba final.

#### 7.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Oral presentations about some topics selected in advance by the professor.	Individual presentation	Face-to-face	02:00	40%	5 / 10	CG3 CG18 CE13
Feedback about other presentations provided by the professor.	Individual presentation	Face-to-face	02:00	30%	5 / 10	CG3 CG18 CE13
Work about the topic of the course that the professor propose to the student previously.	Individual work	Face-to-face	04:00	30%	5 / 10	CG3 CG18 CE13

INTERNATIONAL  
CAMPUS OF  
EXCELLENCEPR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIESANX-PR/CL/001-01  
LEARNING GUIDEE.T.S. de Ingenieros  
Informáticos

## 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.





## 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	<a href="http://babel.ls.fi.upm.es/~susana/teaching/Gestion/">http://babel.ls.fi.upm.es/~susana/teaching/Gestion/</a>
Moodle site	Web resource	<a href="http://moodle.upm.es/titulaciones/oficiales/course/view.php?id=882">http://moodle.upm.es/titulaciones/oficiales/course/view.php?id=882</a>
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.

## 9. Other information

### 9.1. Other information about the subject

**7.4.6 Correctness by Construction**



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

COORDINATION PROCESS OF  
LEARNING ACTIVITIES  
PR/CL/001



E.T.S. de Ingenieros  
Informaticos

# ANX-PR/CL/001-01

## LEARNING GUIDE

### SUBJECT

**103000657 - Correctness By Construction**

### DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

### ACADEMIC YEAR & SEMESTER

2022/23 - Semester 2



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

## Index

---

### Learning guide

1. Description.....	1
2. Faculty.....	1
3. Prior knowledge recommended to take the subject.....	2
4. Skills and learning outcomes .....	2
5. Brief description of the subject and syllabus.....	3
6. Schedule.....	5
7. Activities and assessment criteria.....	8
8. Teaching resources.....	10
9. Other information.....	11



## 1. Description

### 1.1. Subject details

<b>Name of the subject</b>	103000657 - Correctness By Construction
<b>No of credits</b>	6 ECTS
<b>Type</b>	Optional
<b>Academic year of the programme</b>	First year
<b>Semester of tuition</b>	Semester 2
<b>Tuition period</b>	February-June
<b>Tuition languages</b>	English
<b>Degree programme</b>	10AM - Master Universitario en Ingeniería del Software
<b>Centre</b>	10 - Escuela Técnica Superior De Ingenieros Informáticos
<b>Academic year</b>	2022-23

## 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	F - 15:00 - 20:00 Please note that the office hours may change during the course. Please get in touch with the instructor to get an appointment.



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

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

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#### 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

### 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

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

RA26 - Group work skill SC13, SC14, CG17 A

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

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

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.

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.

## 5. Brief description of the subject and syllabus

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### 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.

INTERNATIONAL  
CAMPUS OF  
EXCELLENCEPR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIESANX-PR/CL/001-01  
LEARNING GUIDEE.T.S. de Ingenieros  
Informáticos

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.

## 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
7. From Automated Deduction to Programming with Logic
8. Semantics and Advanced Features
9. CLP and Program Verification via Abstract Interpretation





INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

## 6. Schedule

### 6.1. Subject schedule\*

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



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

7	<b>Event-B and related topics</b> Duration: 02:00 Lecture  <b>Quizzes</b> Duration: 01:00 Problem-solving class			
8	<b>Event-B and related topics</b> Duration: 02:00 Lecture  <b>Quizzes</b> Duration: 01:00 Problem-solving class			
9	<b>Event-B and related topics</b> Duration: 02:00 Lecture  <b>Discussion of Homework</b> Duration: 01:00 Problem-solving class			<b>Homework</b> Individual work Continuous assessment Not Presential Duration: 08:00
10	<b>Quizzes</b> Duration: 01:00 Problem-solving class  <b>Event-B and related topics</b> Duration: 02:00 Lecture			
11	<b>Presentation of term project</b> Duration: 03:00 Additional activities			<b>Term project</b> Group work Continuous assessment Not Presential Duration: 10:00
12	<b>Logic-based programming languages</b> Duration: 03:00 Lecture			
13	<b>Logic-based programming languages</b> Duration: 03:00 Lecture			<b>Homework</b> Individual work Continuous assessment Not Presential Duration: 03:00
14	<b>Logic-based programming languages</b> Duration: 03:00 Lecture			
15	<b>Logic-based programming languages</b> Duration: 03:00 Lecture			<b>Homework</b> Individual work Continuous assessment Not Presential Duration: 03:00
16				
17				<b>Final regular exam</b> Written test Final 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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PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



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Informáticos

\* The schedule is based on an a priori planning of the subject; it might be modified during the academic year, especially considering the COVID19 evolution.



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EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

## 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	15%	0 / 10	CG13 CE14
6	Homework	Individual work	No Presential	04:00	15%	0 / 10	CE13
9	Homework	Individual work	No Presential	08:00	15%	2 / 10	CE13
11	Term project	Group work	No Presential	10:00	40%	4 / 10	CE13
13	Homework	Individual work	No Presential	03:00	7.5%	0 / 10	CE13
15	Homework	Individual work	No Presential	03:00	7.5%	0 / 10	CE13

#### 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	CG13 CE14 CE13

#### 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	CG13 CE14 CE13

INTERNATIONAL  
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EXCELLENCEPR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIESANX-PR/CL/001-01  
LEARNING GUIDEE.T.S. de Ingenieros  
Informáticos

## 7.2. Assessment criteria

- No mandatory activities necessary are to pass via the global 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.
- For the same reason, there is not a minimum grade in the initial homework assignments, as they can be compensated by later assignments.
- 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.
- Active participation in the course can be taken into account to fine-tune the student's final grade.
- 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.
<a href="http://wiki.event-b.org/">http://wiki.event-b.org/</a>	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.
<a href="http://ciao-lang.org/index.html">http://ciao-lang.org/index.html</a>	Web resource	Web site of the Ciao system
An overview of Ciao and its design philosophy	Bibliography	A paper describing the design principles behind Ciao Prolog: <a href="http://cliplab.org/papers/hermenegildo11:ciao-design-tlp.pdf">http://cliplab.org/papers/hermenegildo11:ciao-design-tlp.pdf</a>
<a href="http://wp.software.imdea.org/cbc">wp.software.imdea.org/cbc</a>	Web resource	Web site of the Event-B part of the course

INTERNATIONAL  
CAMPUS OF  
EXCELLENCEPR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIESANX-PR/CL/001-01  
LEARNING GUIDEE.T.S. de Ingenieros  
Informáticos

## 9. Other information

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### 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.

**7.4.7 Computer Security**





INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

COORDINATION PROCESS OF  
LEARNING ACTIVITIES  
PR/CL/001



E.T.S. de Ingenieros  
Informaticos

# ANX-PR/CL/001-01

## LEARNING GUIDE

### SUBJECT

**103000738 - Computer Security**

### DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

### ACADEMIC YEAR & SEMESTER

2022/23 - Semester 1



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

## Index

---

### Learning guide

1. Description.....	1
2. Faculty.....	1
3. Prior knowledge recommended to take the subject.....	2
4. Skills and learning outcomes .....	3
5. Brief description of the subject and syllabus.....	4
6. Schedule.....	5
7. Activities and assessment criteria.....	7
8. Teaching resources.....	9
9. Other information.....	9



## 1. Description

### 1.1. Subject details

<b>Name of the subject</b>	103000738 - Computer Security
<b>No of credits</b>	4 ECTS
<b>Type</b>	Optional
<b>Academic year of the programme</b>	First year
<b>Semester of tuition</b>	Semester 1
<b>Tuition period</b>	September-January
<b>Tuition languages</b>	English
<b>Degree programme</b>	10AM - Master Universitario en Ingeniería del Software
<b>Centre</b>	10 - Escuela Técnica Superior De Ingenieros Informáticos
<b>Academic year</b>	2022-23

## 2. Faculty

### 2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Julio Mariño Carballo	D-2308	julio.marino@upm.es	Tu - 15:00 - 17:00 W - 12:30 - 13:30 Th - 15:00 - 17:00 F - 12:30 - 13:30 Please get in touch with the instructor to get an appointment in order to check his availability.



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

Manuel Carro Liñares (Subject coordinator)	2303	manuel.carro@upm.es	F - 15:00 - 19:00 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.

### 2.3. External faculty

Name and surname	Email	Institution
Srdjan Matic	srdjan.matic@imdea.org	IMDEA Software Institute
Juan Caballero	Juan.caballero@imdea.org	IMDEA Software Institute
Pedro Moreno	pedro.moreno@imdea.org	IMDEA Software Institute
Marco Guarnieri	marco.guarnieri@imdea.org	IMDEA Software Institute
Dario Fiore	Dario.Fiore@imdea.org	IMDEA Software Institute
Ignacio Cascudo	ignacio.cascudo@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 \*

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### 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

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### 5.1. Brief description of the subject

This course gives students a general view of Computer Security. Lectures are divided in independent blocks which provide basic concepts in Computer Security, such as cryptography, software security, information access control, communication network security, or privacy. Each block includes a theory part to give students the basic concepts and a practical exercise to demonstrate and fix the presented concepts. The particular order and length of the topics in the blocks will depend on the schedule of the instructors.

### 5.2. Syllabus

1. Software Security
2. Physical Security
3. Cryptography
4. Network security



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

## 6. Schedule

### 6.1. Subject schedule\*

Week	Classroom activities	Laboratory activities	Distant / On-line	Assessment activities
1	<b>Introduction to Computer Security</b> Duration: 02:00 Lecture			
2	<b>Software security</b> Duration: 02:00 Lecture			
3	<b>Software security</b> Duration: 02:00 Lecture			
4	<b>Software security</b> Duration: 02:00 Lecture			
5	<b>Software security</b> Duration: 02:00 Lecture			<b>Practical problem / exercise on Software Security</b> Individual work Continuous assessment Not Presential Duration: 04:00
6	<b>Physical security</b> Duration: 02:00 Lecture			
7	<b>Physical security</b> Duration: 02:00 Lecture			
8	<b>Physical security</b> Duration: 02:00 Lecture			<b>Practical problem / exercise on Physical Security</b> Individual work Continuous assessment Not Presential Duration: 04:00
9	<b>Cryptography</b> Duration: 02:00 Lecture			
10	<b>Cryptography</b> Duration: 02:00 Lecture			
11	<b>Cryptography</b> Duration: 02:00 Lecture			
12	<b>Cryptography</b> Duration: 02:00 Lecture			<b>Practical problem / exercise on Cryptography</b> Individual work Continuous assessment Not Presential Duration: 04:00



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

13	<b>Network security</b> Duration: 02:00 Lecture			
14	<b>Network security</b> Duration: 02:00 Lecture			
15	<b>Network security</b> Duration: 02:00 Lecture			<b>Practical problem / exercise on Network Security</b> Individual work Continuous assessment Not Presential Duration: 04:00
16				
17				<b>Global exam</b> Written test Final 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.

\* The schedule is based on an a priori planning of the subject; it might be modified during the academic year, especially considering the COVID19 evolution.





INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

## 7. Activities and assessment criteria

### 7.1. Assessment activities

#### 7.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
5	Practical problem / exercise on Software Security	Individual work	No Presential	04:00	25%	2 / 10	CG13 CG7 E CE14 CG3 CG9 CG1 CG8 CE13
8	Practical problem / exercise on Physical Security	Individual work	No Presential	04:00	25%	2 / 10	CG9 CG13 CG14 CG3 CG1 CG7 E CG8
12	Practical problem / exercise on Cryptography	Individual work	No Presential	04:00	25%	2 / 10	CG13 CG3 CG1 CG7 E CG9 CG8
15	Practical problem / exercise on Network Security	Individual work	No Presential	04:00	25%	2 / 10	CG7 E CG9 CG13 CG14 CG3 CG1 CG8

#### 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	CG13 CG14 CE14 CG3 CG1 CG8 CG7 E



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

							CG9 CE13
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### 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 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 each homework assignment can be tested separately in the final exam. A student only needs to make the exercises corresponding to homework assignments that s/he failed either in the regular and extraordinary global exams.
- The 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.

## 8. Teaching resources

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### 8.1. Teaching resources for the subject

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

## 9. Other information

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### 9.1. Other information about the subject

**7.4.8 Agent Based Software Development**



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

COORDINATION PROCESS OF  
LEARNING ACTIVITIES  
PR/CL/001



E.T.S. de Ingenieros  
Informáticos

# ANX-PR/CL/001-01 LEARNING GUIDE

## SUBJECT

**103000538 - Agent-based Software Development**

## DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

## ACADEMIC YEAR & SEMESTER

2022/23 - Semester 2



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

## Index

---

### Learning guide

1. Description.....	1
2. Faculty.....	1
3. Prior knowledge recommended to take the subject.....	2
4. Skills and learning outcomes .....	2
5. Brief description of the subject and syllabus.....	3
6. Schedule.....	5
7. Activities and assessment criteria.....	8
8. Teaching resources.....	11



## 1. Description

### 1.1. Subject details

<b>Name of the subject</b>	103000538 - Agent-Based Software Development
<b>No of credits</b>	6 ECTS
<b>Type</b>	Optional
<b>Academic year of the programme</b>	First year
<b>Semester of tuition</b>	Semester 2
<b>Tuition period</b>	February-June
<b>Tuition languages</b>	English
<b>Degree programme</b>	10AM - Master Universitario en Ingeniería del Software
<b>Centre</b>	10 - Escuela Técnica Superior De Ingenieros Informáticos
<b>Academic year</b>	2022-23

## 2. Faculty

### 2.1. Faculty members with subject teaching role

<b>Name and surname</b>	<b>Office/Room</b>	<b>Email</b>	<b>Tutoring hours *</b>
Ricardo Imbert Paredes (Subject coordinator)	D-5112	ricardo.imbert@upm.es	Tu - 15:00 - 18:00 Th - 15:00 - 17:00 F - 15:00 - 16:00
Jose Maria Barambones Ramirez	5106	j.barambones@upm.es	M - 10:00 - 12:00 Tu - 10:00 - 12:00 W - 10:00 - 12:00

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

INTERNATIONAL  
CAMPUS OF  
EXCELLENCEPR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIESANX-PR/CL/001-01  
LEARNING GUIDEE.T.S. de Ingenieros  
Informáticos

### 3. Prior knowledge recommended to take the subject

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#### 3.1. Recommended (passed) subjects

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

#### 3.2. Other recommended learning outcomes

- Algorithms and data structure
- Programming (Java and Python)

### 4. Skills and learning outcomes \*

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#### 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.

#### 4.2. Learning outcomes

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

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.





## 5. Brief description of the subject and syllabus

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### 5.1. Brief description of the subject

The continuous search for more powerful and of a higher level new abstraction mechanisms has lead nowadays towards a new development paradigm, based on software agents. This approach, which has been so many times referred as the final solution for all the previously unaffordable problems, far from being a "silver bullet", must be considered as another software development paradigm and, as such, subject to the Software Engineering discipline.

This subject will introduce the students into this new paradigm, settling the basic concepts of the technology, offering them a wide perspective of the current Software Engineering efforts in this area, always from a practical and applied perspective.

### 5.2. Syllabus

1. Introduction to agents
  - 1.1. General concepts
  - 1.2. Agent architectures
  - 1.3. Social nature of agents
2. Agent oriented software engineering
  - 2.1. Pitfalls of agent oriented development
  - 2.2. Standards
  - 2.3. Agent communication languages
  - 2.4. Development frameworks
  - 2.5. Methodologies
  - 2.6. Development notations
3. Agent oriented analysis
  - 3.1. Concepts for building agents
  - 3.2. Analysis according to different methodologies
  - 3.3. Goal identification
  - 3.4. Role modelling



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

- 3.5. Interface description
- 4. Agent oriented architectural design
  - 4.1. Architectural design according to different methodologies
  - 4.2. Agent type decision
  - 4.3. System architecture
  - 4.4. Interaction model
- 5. Agent oriented detailed design (part I)
  - 5.1. Detailed design according to different methodologies
  - 5.2. Detailed protocols
  - 5.3. Process specifications
  - 5.4. Ontology design
- 6. Agent implementation
  - 6.1. Introduction to an agent oriented development framework
  - 6.2. Administrative tools
  - 6.3. Execution of an agent
  - 6.4. Agent behaviors
  - 6.5. Agent messaging
- 7. Agent oriented detailed design (part II)
  - 7.1. Ontology construction
  - 7.2. Specification of ACL messages
  - 7.3. Packaging protocols
  - 7.4. Agent detailed desing
- 8. Development process
  - 8.1. Development scenario
  - 8.2. Development strategy
  - 8.3. Development team roles
  - 8.4. Project startup stage
  - 8.5. Project iteration stage



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

## 6. Schedule

### 6.1. Subject schedule\*

Week	Classroom activities	Laboratory activities	Distant / On-line	Assessment activities
1	<b>1. Introduction to agents</b> Duration: 02:00 Lecture  <b>2 Agent oriented software engineering</b> Duration: 00:15 Lecture			<b>Exercise about risks on agent based software engineering</b> Group work Continuous assessment and final examination Presential Duration: 00:45
2	<b>3. Agent oriented analysis</b> Duration: 01:30 Lecture  <b>Second assignment. Analysis of the system</b> Duration: 01:30 Problem-solving class			
3	<b>4 Agent oriented architectural design</b> Duration: 01:30 Lecture  <b>Second assignment. Architectural design of the system</b> Duration: 01:30 Problem-solving class			<b>Exercise about systems topology</b> Group work Continuous assessment and final examination Presential Duration: 01:00
4	<b>5. Agent oriented detailed design (part I)</b> Duration: 01:00 Lecture			<b>Exercise about agent communication protocols</b> Individual work Continuous assessment and final examination Not Presential Duration: 02:00  <b>First assignment. Presentation in the classroom</b> Individual presentation Continuous assessment Presential Duration: 00:15  <b>First assignment. Delivery of the assignment</b> Individual work Continuous assessment and final examination Not Presential Duration: 09:45



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

5	<b>8. Development process</b> Duration: 00:20 Lecture  <b>Second assignment. Workshop of user stories - sprint #1</b> Duration: 00:40 Cooperative activities  <b>6. Agent implementation</b> Duration: 02:00 Problem-solving class			
6	<b>6. Agent implementation</b> Duration: 02:00 Problem-solving class  <b>7. Agent oriented detailed design (part II)</b> Duration: 01:00 Problem-solving class			<b>Exercise about agent implementation</b> Individual work Continuous assessment Not Presential Duration: 05:00
7	<b>Second assignment. Roadmap. Sprint planning #1</b> Duration: 03:00 Cooperative activities			
8	<b>Second assignment. Workshop of user stories - sprint #2</b> Duration: 03:00 Cooperative activities			
9	<b>Second assignment. Integration sprint #1</b> Duration: 02:00 Cooperative activities  <b>Second assignment. Retrospective - sprint #1. Sprint planning #2</b> Duration: 01:00 Cooperative activities			
10	<b>Second assignment. Workshop of user stories - sprint #3</b> Duration: 03:00 Cooperative activities			
11	<b>Second assignment. Integration sprint #2</b> Duration: 02:00 Cooperative activities  <b>Second assignment. Retrospective - sprint #2. Sprint planning #3</b> Duration: 01:00 Cooperative activities			
12	<b>Second assignment. Workshop of user stories - sprint #4</b> Duration: 03:00 Cooperative activities			
13	<b>Second assignment. Integration sprint #3</b> Duration: 02:00 Cooperative activities  <b>Second assignment. Retrospective - sprint #3. Sprint planning #4</b> Duration: 01:00 Cooperative activities			



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

14				
15	<b>Second assignment. Integration sprint #4</b> Duration: 02:00 Cooperative activities			
16				
17				<b>Second assignment. Presentation in the classroom</b> Group presentation Continuous assessment Presential Duration: 04:00  <b>Student implication and participation</b> Other assessment Continuous assessment Presential Duration: 00:00  <b>Second assignment. Delivery of the inform and code</b> Group work Continuous assessment Not Presential Duration: 100:00

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.

\* The schedule is based on an a priori planning of the subject; it might be modified during the academic year, especially considering the COVID19 evolution.



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

## 7. Activities and assessment criteria

### 7.1. Assessment activities

#### 7.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
1	Exercise about risks on agent based software engineering	Group work	Face-to-face	00:45	6%	0 / 10	CE14
3	Exercise about systems topology	Group work	Face-to-face	01:00	6%	0 / 10	CE13
4	Exercise about agent communication protocols	Individual work	No Presential	02:00	3%	0 / 10	CE13
4	First assignment. Presentation in the classroom	Individual presentation	Face-to-face	00:15	1.5%	/ 10	CE13 CE14
4	First assignment. Delivery of the assignment	Individual work	No Presential	09:45	13.5%	3 / 10	CE14 CE13
6	Exercise about agent implementation	Individual work	No Presential	05:00	3%	/ 10	CE14
17	Second assignment. Presentation in the classroom	Group presentation	Face-to-face	04:00	12%	/ 10	CE14 CE13
17	Student implication and participation	Other assessment	Face-to-face	00:00	7%	0 / 10	CE13
17	Second assignment. Delivery of the inform and code	Group work	No Presential	100:00	48%	4 / 10	CE14 CE13

#### 7.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
1	Exercise about risks on agent based software engineering	Group work	Face-to-face	00:45	6%	0 / 10	CE14
3	Exercise about systems topology	Group work	Face-to-face	01:00	6%	0 / 10	CE13
4	Exercise about agent communication protocols	Individual work	No Presential	02:00	3%	0 / 10	CE13
4	First assignment. Delivery of the assignment	Individual work	No Presential	09:45	13.5%	3 / 10	CE14 CE13

#### 7.1.3. Referred (re-sit) examination



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Exercise about risks on agent based software engineering	Individual work	Face-to-face	03:00	6%	0 / 10	CE14
First assignment	Individual work	Face-to-face	03:00	13.5%	3 / 10	CE13 CE14
Exercise about systems topology	Individual work	Face-to-face	03:00	6%	0 / 10	CE13
Exercise about agent communication protocols	Individual work	Face-to-face	03:00	3%	0 / 10	CE13
Second practical assignment	Group work	Face-to-face	50:00	48%	4 / 10	CE13 CE14

## 7.2. Assessment criteria

### Progressive evaluation

The subject is graded following a continuous assessment.

The subject's progressive evaluation consist of:

- *Individual assignments (18% of the final grade)*: the student must complete several individual assignments related to some specific aspects of the subject. Some of these activities are performed during class time. These activities, except the exercise about agent implementation, are recoverable in the global and extraordinary evaluation, always that they had been failed (grade below 5).
- *First assignment (15% of the final grade)*: the first assignment gives the student a width perspective of the agent paradigm and technology. The student delivers a document with his work and prepares a presentation for a specific live session. Since there will not be enough time in that session for all the students to present their findings, the document weight will be for them of 15% of the final grade, while those presenting will divide their grade between the document (13,5%) and the presentation (1,5%). Only the document part is recoverable in the global and extraordinary evaluation when it has been failed (grade below 3). To pass the subject the student must achieve a minimum grade of 3 between grade and presentation.
- *Second assignment (60% of the final grade)*: the second assignment allows the student to learn by doing concepts related to agent analysis, design, software project, agile methodologies, software integration, quality assurance and software configuration management, among others. Students participate in the group development of a big system and, at the end of the course, deliver their code and a document with their work. They also prepare a presentation for a specific classroom session. Only the code and document part is recoverable in the global and extraordinary evaluation when it has been failed (grade below 4). To pass the subject the student must achieve a minimum grade of 4 between grade and presentation.

INTERNATIONAL  
CAMPUS OF  
EXCELLENCEPR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIESANX-PR/CL/001-01  
LEARNING GUIDEE.T.S. de Ingenieros  
Informáticos

- *Student participation (7% 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.

### 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 28,5% of the final grade this will be the margin for passing the subject during the global evaluation, except when the second assignment has been failed (grade under 4). The second assignment is not recoverable for the global evaluation since it is delivered the day before the subject's exam date.

### Extraordinary evaluation

For the extraordinary term evaluation the student can repeat the following activities, only if they were graded under 5:

- The individual assignments (15% of the final grade).
- The first assignment (13,5% of the final grade).
- The correction of the second assignment (48% of the final grade).

### 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.





## 8. Teaching resources

### 8.1. Teaching resources for the subject

Name	Type	Notes
de Antonio, A. and Imbert, R. (2005) Combining Requirements Engineering and Agents. In A. Silva and J. L. Maté (eds.) Requirements Engineering for Sociotechnical Systems, pp. 68-83. Idea Group Publishing, Hersey, PA, USA.	Bibliography	Agent oriented analysis 
Bellifemine, F., Caire, G. and Greenwood, D. (2007) Developing Multi-Agent Systems with JADE. John Wiley & Sons Ltd, England.	Bibliography	Agent implementation
Bratman, M. E., Israel, D. and Pollack, M. (1988) Plans and Resource-Bounded Practical Reasoning. Computational Intelligence, 4(4): pp. 349-355.	Bibliography	Introduction to agents: concepts
Brooks, R. A. (1991) Intelligence without Representation. Artificial Intelligence, 47: p. 139-159.	Bibliography	Introduction to agents: reactive architectures
Franklin, S. and Graesser, A. (1996) Is It an Agent, or Just a Program?: A Taxonomy for Autonomous Agents. In Intelligent Agents III. Agent Theories, Architectures and Languages (ATAL-96), vol. 1193. Springer-Verlag, Berlin, Germany.	Bibliography	Introduction to agents: definition



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

Jennings, N. R., Sycara, K. and Wooldridge, M. (1998) A Roadmap of Agent Research and Development. Journal of Autonomous Agents and Multi-Agent Systems, 1(1): pp. 7-38.	Bibliography	Introduction to agents: general view
Müller, H. J. (1997) Towards Agent Systems Engineering. Data & Knowledge Engineering, 23: pp. 217-245.	Bibliography	Architecture conceptualization and design
Padgham, L. and Winikoff, M. (2004) Developing Intelligent Agent Systems. John Wiley & Sons Ltd, England.	Bibliography	Agent oriented development
Rao, A. S. and Georgeff, M. P. (1995) BDI Agents: From Theory to Practice. In V. Lesser (ed.), Proceedings of the First International Conference on Multi-Agent Systems, ICMAS-95, pp. 312-319. MIT Press, San Francisco.	Bibliography	Introduction to agents: BDI
Shoham, Y. and Leyton-Brown, K. (2009) Multiagent Systems. Algorithmic, Game-Theoretic, and Logical Foundations. Cambridge University Press, USA.	Bibliography	Design of multiagent systems
Sterling, L.S. and Taveter, K. (2009) The Art of Agent-Oriented Modeling. The MIT Press, Cambridge, Massachusetts, USA.	Bibliography	Modeling of multiagent systems
Sycara, K. (1998) Multiagent Systems. AI Magazine, 19(2): pp. 79-92.	Bibliography	Social nature of agents
Wooldridge, M. (2002) An Introduction to MultiAgent Systems. John Wiley & Sons Ltd. Chichester, England.	Bibliography	Introduction to agents: general view



Wooldridge, M., Jennings, N. R., Kinny, D. (2000) The Gaia Methodology For Agent-Oriented Analysis And Design. Autonomous Agents and Multi-Agent Systems, 3(3), pp. 285-312. Kluwer Academic publishers.	Bibliography	Agent oriented methodology: Gaia
Zambonelli, F., Jennings, N. R. and Wooldridge, M. (2003) Developing Multiagent Systems: The Gaia Methodology. ACM Transactions on Software Engineering and Methodology, 12(3): pp. 317-370.	Bibliography	Agent oriented methodology: Gaia
<a href="http://moodle.upm.es/titulaciones/oficiales/course/view.php?id=1054">http://moodle.upm.es/titulaciones/oficiales/course/view.php?id=1054</a>	Web resource	Subject Moodle site
Room assigned by the school for the classes	Equipment	Lecture and group work room

**7.4.9 Experimental Software Engineering**



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

COORDINATION PROCESS OF  
LEARNING ACTIVITIES  
PR/CL/001



E.T.S. de Ingenieros  
Informáticos

# ANX-PR/CL/001-01

## LEARNING GUIDE

### SUBJECT

**103000542 - Experimental Software Engineering**

### DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

### ACADEMIC YEAR & SEMESTER

2022/23 - Semester 2



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

## Index

---

### Learning guide

1. Description.....	1
2. Faculty.....	1
3. Prior knowledge recommended to take the subject.....	2
4. Skills and learning outcomes .....	2
5. Brief description of the subject and syllabus.....	3
6. Schedule.....	6
7. Activities and assessment criteria.....	8
8. Teaching resources.....	11



## 1. Description

### 1.1. Subject details

<b>Name of the subject</b>	103000542 - Experimental Software Engineering
<b>No of credits</b>	6 ECTS
<b>Type</b>	Optional
<b>Academic year of the programme</b>	First year
<b>Semester of tuition</b>	Semester 2
<b>Tuition period</b>	February-June
<b>Tuition languages</b>	English
<b>Degree programme</b>	10AM - Master Universitario en Ingeniería del Software
<b>Centre</b>	10 - Escuela Técnica Superior De Ingenieros Informáticos
<b>Academic year</b>	2022-23

## 2. Faculty

### 2.1. Faculty members with subject teaching role

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



### 3. Prior knowledge recommended to take the subject

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#### 3.1. Recommended (passed) subjects

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

#### 3.2. Other recommended learning outcomes

- Basic knowledge of statistics.

### 4. Skills and learning outcomes \*

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#### 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

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. Learning outcomes

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.

\* 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

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### 5.1. Brief description of the subject

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.



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

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

## 5.2. Syllabus

### 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



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

5.3. Parametric tests for related samples

5.4. Non parametric tests



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

## 6. Schedule

### 6.1. Subject schedule\*

Week	Classroom activities	Laboratory activities	Distant / On-line	Assessment activities
1	<b>Lecture: Chapter 1</b> Duration: 04:00 Lecture			
2	<b>Lecture: Chapter 2</b> Duration: 02:00 Lecture  <b>Problem-solving activity: Chapter 3</b> Duration: 02:00 Problem-solving class			
3	<b>Lecture: Chapter 3</b> Duration: 01:00 Lecture  <b>Problem-solving activity: Chapter 3</b> Duration: 01:00 Problem-solving class	<b>Lecture: Chapter 5</b> Duration: 02:00 Laboratory assignments		
4	<b>Lecture: Chapter 4</b> Duration: 02:00 Lecture  <b>Problem-solving activity: Chapter 4</b> Duration: 02:00 Problem-solving class			
5	<b>Brainstorming and group discussion of assignment 1</b> Duration: 02:00 Problem-solving class	<b>Lecture: Chapter 5</b> Duration: 02:00 Laboratory assignments		
6	<b>Brainstorming and group discussion of assignment 1</b> Duration: 02:00 Problem-solving class	<b>Lecture: Chapter 5</b> Duration: 02:00 Laboratory assignments		
7				
8		<b>Lecture: Chapter 5</b> Duration: 04:00 Laboratory assignments		
9				<b>Presentation of assignment 1</b> Group presentation Continuous assessment Presental Duration: 04:00



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

10		Brainstorming and group discussion of assignment 2 Duration: 04:00 Laboratory assignments		
11		Brainstorming and group discussion of assignment 2 Duration: 04:00 Laboratory assignments		
12				Submission of assignment 2 Group work Continuous assessment Not Presential Duration: 10:00
13				
14				
15				
16				
17				Re-submission of assignment 1 Group work Final examination Presential Duration: 01:00  Re-submission of assignment 2 Group work Final examination Not Presential Duration: 01:00

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.

\* The schedule is based on an a priori planning of the subject; it might be modified during the academic year, especially considering the COVID19 evolution.



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

## 7. Activities and assessment criteria

### 7.1. Assessment activities

#### 7.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
9	Presentation of assignment 1	Group presentation	Face-to-face	04:00	50%	5 / 10	CG9 CG13 CG7 E CG14 CE14 CG3 CG18 CG1 CG8 CG6 CE13
12	Submission of assignment 2	Group work	No Presential	10:00	50%	5 / 10	CG7 E CG9 CG13 CG14 CE14 CG3 CG18 CG1 CG8 CG6 CE13

#### 7.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
17	Re-submission of assignment 1	Group work	Face-to-face	01:00	50%	5 / 10	CG7 E CG9 CG13 CG14 CE14 CG3 CG18 CG1 CG8 CG6 CE13



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

17	Re-submission of assignment 2	Group work	No Presential	01:00	50%	5 / 10	CG7 E CG9 CG13 CG14 CE14 CG3 CG18 CG1 CG8 CG6 CE13
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### 7.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Second re-submission of assignment 1	Group work	Face-to-face	01:00	50%	5 / 10	CG7 E CG9 CG13 CG14 CE14 CG3 CG18 CG1 CG8 CG6 CE13
Second re-submission of assignment 2	Group work	Face-to-face	01:00	50%	5 / 10	



## 7.2. Assessment criteria

### Progressive evaluation period:

- Students will be evaluated using the assignments only.
- No examination will be made.
- The assessment of assignments will depend on the correctness of the results.
- Additionally, for assignment 1 the presentation made by the students will be taken into consideration.
- The final grade will be calculated using a weighted average (each assignment counts 50% of final score).

### 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. It is not possible to submit assignments for which there is not a submission in the progressive evaluation period. In no case assignments that have a score equal or greater than 5 will be re-submitted.

### 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 assignments that do not reach the minimum score required. In no case assignments that have a score equal or greater than 5 will be re-submitted.





## 8. Teaching resources

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### 8.1. Teaching resources for the subject

Name	Type	Notes
Natalia Juristo, Ana Moreno. Basics of software engineering experimentation. Kluwer 2001	Bibliography	
Claes Wohlin et al. Experimentation in software engineering: an introduction. Kluwer 2000.	Bibliography	
Course Moodle site	Web resource	<a href="http://www.moodle.upm.es">www.moodle.upm.es</a>
Laboratory	Equipment	TBD
Room	Equipment	MUIS room

**7.4.10 Fundamentals of Business Administration**



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

COORDINATION PROCESS OF  
LEARNING ACTIVITIES  
PR/CL/001



E.T.S. de Ingenieros  
Informaticos

# 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

2022/23 - Semester 2



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

## Index

---

### Learning guide

1. Description.....	1
2. Faculty.....	1
3. Skills and learning outcomes .....	2
4. Brief description of the subject and syllabus.....	3
5. Schedule.....	4
6. Activities and assessment criteria.....	6
7. Teaching resources.....	8
8. Other information.....	8



## 1. Description

### 1.1. Subject details

<b>Name of the subject</b>	103000680 - Fundamentals Of Business Administration
<b>No of credits</b>	4 ECTS
<b>Type</b>	Optional
<b>Academic year of the programme</b>	First year
<b>Semester of tuition</b>	Semester 2
<b>Tuition period</b>	February-June
<b>Tuition languages</b>	English
<b>Degree programme</b>	10AM - Master Universitario en Ingeniería del Software
<b>Centre</b>	10 - Escuela Técnica Superior De Ingenieros Informáticos
<b>Academic year</b>	2022-23

## 2. Faculty

### 2.1. Faculty members with subject teaching role

<b>Name and surname</b>	<b>Office/Room</b>	<b>Email</b>	<b>Tutoring hours *</b>
Ebru Susur Donerkan (Subject coordinator)	Bl.5 Des.5217	ebru.susur@upm.es	Th - 14:00 - 15:00

\* 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

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

RA77 - Understands basic business principles

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

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

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### 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. Planning the business
7. Organizational design
8. Managing human resources
9. Leading the business
10. Controlling the business
11. Accounting information and finance
12. Business ethics and communication



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

## 5. Schedule

### 5.1. Subject schedule\*

Week	Classroom activities	Laboratory activities	Distant / On-line	Assessment activities
1	<b>Course foundations and Intro</b> Duration: 02:00 Lecture			
2	<b>Global business environment</b> Duration: 02:00 Lecture			
3	<b>Managers and identity</b> Duration: 02:00 Cooperative activities			
4	<b>Business strategy and modelling</b> Duration: 02:00 Lecture			
5	<b>Value proposition</b> Duration: 02:00 Lecture			
6	<b>Value creation, delivery, and capture</b> Duration: 02:00 Lecture			
7	<b>Managing the business</b> Duration: 02:00 Lecture			
8	<b>Planning the business</b> Duration: 02:00 Lecture			<b>Business concept note</b> Group presentation Continuous assessment and final examination Presentational Duration: 01:00
9	<b>Organizational design</b> Duration: 02:00 Lecture			
10	<b>Managing human resources</b> Duration: 02:00 Lecture			
11	<b>Leading the business</b> Duration: 02:00 Lecture			
12	<b>Controlling the business</b> Duration: 02:00 Lecture			
13	<b>Accounting information and finance</b> Duration: 02:00 Lecture			





INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

14	<b>Business ethics and communication</b> Duration: 02:00 Cooperative activities			
15				<b>Final presentation</b> Group presentation Continuous assessment and final examination Presental Duration: 02:00  <b>Final report</b> Group work Continuous assessment and final examination Presental Duration: 04:00  <b>Attendance and participation</b> Individual work Continuous assessment and final examination Presental 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.

\* The schedule is based on an a priori planning of the subject; it might be modified during the academic year, especially considering the COVID19 evolution.



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

## 6. Activities and assessment criteria

### 6.1. Assessment activities

#### 6.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
8	Business concept note	Group presentation	Face-to-face	01:00	20%	5 / 10	CG18 CE13 CE14 CG1 CG8
15	Final presentation	Group presentation	Face-to-face	02:00	25%	5 / 10	CG18 CE13 CE14 CG1 CG8
15	Final report	Group work	Face-to-face	04:00	35%	5 / 10	CE13 CE14 CG1 CG8
15	Attendance and participation	Individual work	Face-to-face	02:00	20%	5 / 10	CG18 CE13

#### 6.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
8	Business concept note	Group presentation	Face-to-face	01:00	20%	5 / 10	CG18 CE13 CE14 CG1 CG8
15	Final presentation	Group presentation	Face-to-face	02:00	25%	5 / 10	CG18 CE13 CE14 CG1 CG8
15	Final report	Group work	Face-to-face	04:00	35%	5 / 10	CE13 CE14 CG1 CG8



15	Attendance and participation	Individual work	Face-to-face	02:00	20%	5 / 10	CG18 CE13
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### 6.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Course evaluation exam	Individual work	Face-to-face	04:00	80%	5 / 10	CG18 CE13 CE14 CG1 CG8

## 6.2. Assessment criteria

### Progressive and global evaluation:

Students will complete a group project. This project is based on developing a business plan for the creation of 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 on a continuous basis throughout the semester, and they will receive feedback from the lecture accordingly.

- A business concept note will be prepared throughout the first part of the course and presented 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. This examination item cannot be recovered by the extraordinary exam.**

### Extraordinary exam:



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

- The course evaluation exam as the extraordinary exam can only contribute to a maximum of 80% of the final grade, and will only be provided to the students who pass the "attendance and participation" item.

## 7. Teaching resources

### 7.1. Teaching resources for the subject

Name	Type	Notes
Ebert and Griffin (2016): Business Essentials. Prentice Hall	Bibliography	
Johnson et al. (2014): Exploring Strategy: Text and Cases. Pearson	Bibliography	
Robbins and Coulter (2017): Management. Pearson	Bibliography	Main book

## 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.

**7.4.11 Adaptive Systems**



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

COORDINATION PROCESS OF  
LEARNING ACTIVITIES  
PR/CL/001



E.T.S. de Ingenieros  
Informaticos

# ANX-PR/CL/001-01

## LEARNING GUIDE

### SUBJECT

**103000739 - Adaptive Systems**

### DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

### ACADEMIC YEAR & SEMESTER

2022/23 - Semester 1

INTERNATIONAL  
CAMPUS OF  
EXCELLENCEPR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIESANX-PR/CL/001-01  
LEARNING GUIDEE.T.S. de Ingenieros  
Informáticos

## Index

---

### Learning guide

1. Description.....	1
2. Faculty.....	1
3. Prior knowledge recommended to take the subject.....	2
4. Skills and learning outcomes .....	2
5. Brief description of the subject and syllabus.....	3
6. Schedule.....	5
7. Activities and assessment criteria.....	7
8. Teaching resources.....	11
9. Other information.....	12



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informaticos

## 1. Description

### 1.1. Subject details

<b>Name of the subject</b>	103000739 - Adaptive Systems
<b>No of credits</b>	4 ECTS
<b>Type</b>	Optional
<b>Academic year of the programme</b>	First year
<b>Semester of tuition</b>	Semester 1
<b>Tuition period</b>	September-January
<b>Tuition languages</b>	English
<b>Degree programme</b>	10AM - Master Universitario en Ingenieria del Software
<b>Centre</b>	10 - Escuela Tecnica Superior De Ingenieros Informaticos
<b>Academic year</b>	2022-23

## 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	Sin horario. The tutoring table can be found at: <a href="https://docs.google.com/spreadsheets/d/1Zi99dtPBXiFFJg4HUSAUelJ2M0QijPUeTSmv1FTeNOY/edit#gid=0">https://docs.google.com/spreadsheets/d/1Zi99dtPBXiFFJg4HUSAUelJ2M0QijPUeTSmv1FTeNOY/edit#gid=0</a>





Jaime Ramirez Rodriguez (Subject coordinator)	5112	jaime.ramirez@upm.es	Sin horario. The tutoring table can be found at: <a href="https://docs.google.com/spreadsheets/d/1Zi99dtPBXiFFJg4HUSAUelj2M0QijPUeTSmv1FTeNOY/edit#gid=0">https://docs.google.com/spreadsheets/d/1Zi99dtPBXiFFJg4HUSAUelj2M0QijPUeTSmv1FTeNOY/edit#gid=0</a>
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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

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#### 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 \*

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#### 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

INTERNATIONAL  
CAMPUS OF  
EXCELLENCEPR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIESANX-PR/CL/001-01  
LEARNING GUIDEE.T.S. de Ingenieros  
Informáticos

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

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#### 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.

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.

By designing and testing improved forms of interactive collaboration between humans and digital assistants, we can enable decision-making processes that better leverage the strengths of both partners. To make the interaction between them more fruitful, we can resort to dialogue systems based on natural language processing techniques.

Therefore, one of the topics of the course will be devoted to dialogue systems taking as a case study the cognitive service of IBM, Watson Assistant. Likewise, the problem of designing dialogue systems that are truly adaptive to the user and not mere natural language interfaces for a database will be addressed.

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
3. Dialog Systems
4. Technology-enhanced adaptive learning



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

## 6. Schedule

### 6.1. Subject schedule\*

Week	Classroom activities	Laboratory activities	Distant / On-line	Assessment activities
1	<b>Presentation of the subject</b> Duration: 02:00 Lecture			
2	<b>User modeling for Adaptive Systems and Adaptive Web</b> Duration: 02:00 Lecture			
3	<b>Recommender Systems</b> Duration: 02:00 Lecture			
4	<b>Recommender Systems</b> Duration: 02:00 Lecture			
5	<b>Recommender Systems</b> Duration: 02:00 Lecture			<b>Exam</b> Online test Continuous assessment and final examination Not Presential Duration: 01:00
6	<b>Workshop associated with practical exercise 1</b> Duration: 02:00 Laboratory assignments			<b>Practical exercise 1</b> Group work Continuous assessment and final examination Not Presential Duration: 07:00
7	<b>Recommender Systems</b> Duration: 02:00 Lecture			<b>Practical exercise 1</b> Group work Continuous assessment and final examination Not Presential Duration: 07:00
8	<b>Recommender Systems</b> Duration: 02:00 Lecture			<b>Practical exercise 1</b> Group work Continuous assessment and final examination Not Presential Duration: 20:00
9	<b>Workshop associated with practical exercise 2</b> Duration: 02:00 Laboratory assignments			<b>Practical exercise 2</b> Group work Continuous assessment and final examination Not Presential Duration: 20:00



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

10	<b>Recommender Systems</b> Duration: 02:00 Lecture			<b>Practical exercise 2</b> Group work Continuous assessment and final examination Not Presential Duration: 10:00
11	<b>Dialog Systems</b> Duration: 02:00 Lecture			<b>Practical exercise 2</b> Group work Continuous assessment and final examination Not Presential Duration: 10:00
12	<b>Technology-enhanced adaptive learning</b> Duration: 02:00 Lecture			
13	<b>Technology-enhanced adaptive learning</b> Duration: 02:00 Lecture			
14	<b>Technology-enhanced adaptive learning</b> Duration: 02:00 Lecture			
15	<b>Research topic presentations</b> Duration: 02:00 Additional activities			<b>Research topic analysis</b> Group work Continuous assessment Presential Duration: 08:00  <b>Design of Adaptive Tutoring System</b> Group work Continuous assessment Presential Duration: 00:00
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.

\* The schedule is based on an a priori planning of the subject; it might be modified during the academic year, especially considering the COVID19 evolution.



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

## 7. Activities and assessment criteria

### 7.1. Assessment activities

#### 7.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
5	Exam	Online test	No Presential	01:00	10%	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	10%	5 / 10	CG9 CG13 CE14 CG8 CG18 CE13



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

15	Research topic analysis	Group work	Face-to-face	08:00	12.5%	5 / 10	CG13 CE14 CG3 CE13
15	Design of Adaptive Tutoring System	Group work	Face-to-face	00:00	12.5%	5 / 10	CG13 CE14 CG9 CG18 CE13

### 7.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
5	Exam	Online test	No Presential	01:00	10%	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	10%	5 / 10	CG9 CG13 CE14 CG8 CG18 CE13



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

### 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:

$$FG = 0.25 \cdot PEG1 + 0.40 \cdot PEG2 + 0.10 \cdot EG + 0.125 \cdot RTG + 0.125 \cdot DTG + 0.05 \cdot CPG, \text{ if } CPG \geq 6$$

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

Where all the grades take values between 0 and 10.





The classroom participation grade stands for the ratio of attendance multiplied by 10. So, students will have to attend at least 60% of the classes to pass the subject in the regular period. However, if a student cannot attend a lesson for some justified reason (job duties, illness, etc.), he/she will be able to compensate for a non-attendance by doing the replacement task required by the professor in due course.

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

### 1.2. Global evaluation

If the student fails to pass the 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.

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

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### 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.

**7.4.12 Deep Learning and Software Engineering**



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

COORDINATION PROCESS OF  
LEARNING ACTIVITIES  
PR/CL/001



E.T.S. de Ingenieros  
Informaticos

# ANX-PR/CL/001-01

## LEARNING GUIDE

### SUBJECT

**103001022 - Deep Learning And Software Engineering**

### DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

### ACADEMIC YEAR & SEMESTER

2022/23 - Semester 1



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

## Index

---

### Learning guide

1. Description.....	1
2. Faculty.....	1
3. Skills and learning outcomes .....	2
4. Brief description of the subject and syllabus.....	3
5. Schedule.....	5
6. Activities and assessment criteria.....	7
7. Teaching resources.....	9



## 1. Description

### 1.1. Subject details

<b>Name of the subject</b>	103001022 - Deep Learning And Software Engineering
<b>No of credits</b>	4 ECTS
<b>Type</b>	Optional
<b>Academic year of the programme</b>	First year
<b>Semester of tuition</b>	Semester 1
<b>Tuition period</b>	September-January
<b>Tuition languages</b>	English
<b>Degree programme</b>	10AM - Master Universitario en Ingenieria del Software
<b>Centre</b>	10 - Escuela Tecnica Superior De Ingenieros Informaticos
<b>Academic year</b>	2022-23

## 2. Faculty

### 2.1. Faculty members with subject teaching role

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

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



INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informaticos

### 3. Skills and learning outcomes \*

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#### 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)

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

#### 3.2. Learning outcomes

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

RA23 - Time organization capability SC13, SC14 K

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

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.

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

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.

## 4. Brief description of the subject and syllabus

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### 4.1. 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.

### 4.2. 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. Software Engineering for Deep Learning

- 2.1. Developing a DL System
- 2.2. SE Challenges of DL
- 2.3. Incorporating SE practices to DL



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PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
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### 3. Deep Learning for Software Engineering

#### 3.1. SE Problems that Use DL

#### 3.2. DL Architectures Used to Solve SE Problems

#### 3.3. Integrating DL into SE



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PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



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## 5. Schedule

### 5.1. Subject schedule\*

Week	Classroom activities	Laboratory activities	Distant / On-line	Assessment activities
1	<b>Chapter 1: Introduction to DL</b> Duration: 02:00 Lecture			
2	<b>Chapter 1: Introduction to DL</b> Duration: 02:00 Lecture			
3	<b>Chapter 1: Introduction to DL</b> Duration: 02:00 Lecture			
4	<b>Chapter 1: Introduction to DL</b> Duration: 02:00 Problem-solving class			
5	<b>Chapter 2: SE for DL</b> Duration: 02:00 Lecture			
6	<b>Chapter 2: SE for DL</b> Duration: 02:00 Lecture			
7	<b>Chapter 2: SE for DL</b> Duration: 02:00 Lecture			
8	<b>Chapter 2: Follow up of Assignment 1</b> Duration: 02:00 Cooperative activities			
9	<b>Chapter 2: Follow up of Assignment 1</b> Duration: 02:00 Cooperative activities			<b>Submission of Assignment 1</b> Group work Continuous assessment Not Presential Duration: 10:00
10				<b>Presentation of Assignment 1</b> Group presentation Continuous assessment Presential Duration: 02:00
11	<b>Chapter 3: DL for SE</b> Duration: 02:00 Lecture			
12	<b>Chapter 3: DL for SE</b> Duration: 02:00 Lecture			



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EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

13	<b>Chapter 3: DL for SE</b> Duration: 02:00 Lecture			
14	<b>Chapter 3: Follow up of Assignment 2</b> Duration: 02:00 Cooperative activities			
15	<b>Chapter 3: Follow up of Assignment 2</b> Duration: 02:00 Cooperative activities			<b>Submission of Assignment 2</b> Group work Continuous assessment Not Presential Duration: 10:00
16				<b>Presentation of Assignment 2</b> Group presentation Continuous assessment Presential Duration: 02:00
17				<b>Re-submission of Assignment 1</b> Group work Final examination Not Presential Duration: 10:00  <b>Re-representation of Assignment 1</b> Group presentation Final examination Presential Duration: 02:00  <b>Re-representation of Assignment 2</b> Group presentation Final examination Presential Duration: 02:00  <b>Re-submission of Assignment 2</b> Group work Final examination Not Presential Duration: 10:00

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.

\* The schedule is based on an a priori planning of the subject; it might be modified during the academic year, especially considering the COVID19 evolution.



## 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 of Assignment 1	Group work	No Presential	10:00	40%	3 / 10	CG13 CG14 CE13 CG1 CE14
10	Presentation of Assignment 1	Group presentation	Face-to-face	02:00	10%	3 / 10	CG18
15	Submission of Assignment 2	Group work	No Presential	10:00	40%	3 / 10	CG13 CG14 CE13 CG1 CE14
16	Presentation of Assignment 2	Group presentation	Face-to-face	02:00	10%	3 / 10	CG18

#### 6.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
17	Re-submission of Assignment 1	Group work	No Presential	10:00	40%	5 / 10	CE13 CG1 CG13 CG14 CE14
17	Re-presentation of Assignment 1	Group presentation	Face-to-face	02:00	10%	5 / 10	CG18
17	Re-presentation of Assignment 2	Group presentation	Face-to-face	02:00	10%	5 / 10	CG18
17	Re-submission of Assignment 2	Group work	No Presential	10:00	40%	5 / 10	CE13 CG1 CG13 CG14 CE14



### 6.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Second re-submission of Assignment 1	Group work	Face-to-face	10:00	40%	5 / 10	CG1 CG13 CG14 CE13 CE14
Second re-presentation of Assignment 1	Group presentation	Face-to-face	02:00	10%	5 / 10	CG18
Second re-presentation of Assignment 2	Group presentation	Face-to-face	02:00	10%	5 / 10	CG18
Second re-submission of Assignment 2	Group work	Face-to-face	10:00	40%	5 / 10	CE13 CG1 CG13 CG14 CE14

## 6.2. Assessment criteria

### Progressive evaluation period:

- Students will be evaluated using the evaluation tasks described above.
- No examination will be made.
- The final grade will be calculated using a weighted average as explained above.

### 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 (repeat those presentations) that do not reach the minimum score required. It is not possible to complete evaluation tasks for which there is not a submission/presentation in the progressive evaluation period. In no case assignments/presentations that have a score equal 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 or greater than 5 will be repeated.

## 7. Teaching resources

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### 7.1. 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	

**7.4.13 E-Health: Promoting Active And Healthy Ageing**





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LEARNING ACTIVITIES  
PR/CL/001



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Informaticos

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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

2022/23 - Semester 1



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PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

## Index

---

### Learning guide

1. Description.....	1
2. Faculty.....	1
3. Prior knowledge recommended to take the subject.....	2
4. Skills and learning outcomes .....	2
5. Brief description of the subject and syllabus.....	3
6. Schedule.....	4
7. Activities and assessment criteria.....	6
8. Teaching resources.....	8
9. Other information.....	9



## 1. Description

### 1.1. Subject details

<b>Name of the subject</b>	103001025 - E-Health: Promoting Active And Healthy Ageing
<b>No of credits</b>	4 ECTS
<b>Type</b>	Optional
<b>Academic year of the programme</b>	First year
<b>Semester of tuition</b>	Semester 1
<b>Tuition period</b>	September-January
<b>Tuition languages</b>	English
<b>Degree programme</b>	10AM - Master Universitario en Ingeniería del Software
<b>Centre</b>	10 - Escuela Técnica Superior De Ingenieros Informáticos
<b>Academic year</b>	2022-23

## 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	M - 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

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LEARNING ACTIVITIESANX-PR/CL/001-01  
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Informáticos

member in charge.

### 3. Prior knowledge recommended to take the subject

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#### 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 \*

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#### 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



## 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

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### 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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EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

## 6. Schedule

### 6.1. Subject schedule\*

Week	Classroom activities	Laboratory activities	Distant / On-line	Assessment activities
1	<b>1. Active and Healthy Ageing: 1.1 Course introduction 1.2. Definitions and frameworks</b> Duration: 02:00 Lecture			
2	<b>2. Clinical perspective.</b> Duration: 02:00 Lecture			
3	<b>6. Introduction to AHA project. 6.1 Topic choice</b> Duration: 02:00 Cooperative activities			
4	<b>3. Political perspective.</b> Duration: 02:00 Lecture			
5	<b>5. Technological perspective I</b> Duration: 02:00 Lecture			<b>Assignment of political and technological perspective</b> Individual presentation Continuous assessment and final examination Not Presential Duration: 04:00
6	<b>6. AHA Project. 6.1. Topic choice and planning of context of use observation</b> Duration: 02:00 Additional activities			
7	<b>4. Social and personal perspective</b> Duration: 02:00 Lecture			<b>Assessment. AHA Project: Planification of the observation of the context of use</b> Group work Continuous assessment Not Presential Duration: 02:00
8	<b>5. Technological perspective II</b> Duration: 02:00 Lecture			
9	<b>6. AHA project. 6.2 Observation, analysis and specification of context of use</b> Duration: 02:00 Additional activities			
10				<b>Assessment. AHA Project: Context of use</b> Group presentation Continuous assessment Presential Duration: 02:00



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LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



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Informáticos

11	<b>6. AHA Project. 6.3 Design and implementation of a prototype</b> Duration: 02:00 Additional activities			
12				<b>Assessment. AHA Project: prototype</b> Group presentation Continuous assessment Presental Duration: 02:00
13	<b>6. AHA project. 6.4 Evaluation of the prototype. Expert evaluation of heuristics</b> Duration: 02:00 Additional activities			
14	<b>6. AHA Project. 6.5 Analysis of results and reporting.</b> Duration: 02:00 Additional activities			
15	<b>6. AHA project. Tutoring</b> Duration: 02:00 Additional activities			
16	<b>6. AHA project. Tutoring</b> Duration: 02:00 Additional activities			
17				<b>Final Exam: Assessment: AHA project. Results.</b> Group presentation Continuous assessment Presental 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.

\* The schedule is based on an a priori planning of the subject; it might be modified during the academic year, especially considering the COVID19 evolution.



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PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

## 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 presentation	No Presential	04:00	30%	/ 10	CG1 CG18
7	Assessment. AHA Project: Planification of the observation of the context of use	Group work	No Presential	02:00	10%	/ 10	CG1 CG18
10	Assessment. AHA Project: Context of use	Group presentation	Face-to-face	02:00	20%	/ 10	CG1 CG18
12	Assessment. AHA Project: prototype	Group presentation	Face-to-face	02:00	20%	/ 10	CG1 CG18 CG8
17	Final Exam: Assessment: AHA project. Results.	Group presentation	Face-to-face	03:00	20%	/ 10	CG1 CG18 CG8

#### 7.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
5	Assignment of political and technological perspective	Individual presentation	No Presential	04:00	30%	/ 10	CG1 CG18

#### 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	CG1 CG18 CG8





## 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



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LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

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: <a href="http://www.who.int/ageing/publications/age_friendly_cities_guide/en/">http://www.who.int/ageing/publications/age_friendly_cities_guide/en/</a>
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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PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

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

## 9. Other information

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### 9.1. Other information about the subject

This course contributes to the objectives 4 and 10 of the UN Sustainable Development Goals.

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.

**7.4.14 Strategic Management and Entrepreneurship**



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LEARNING ACTIVITIES  
PR/CL/001



E.T.S. de Ingenieros  
Informaticos

# ANX-PR/CL/001-01

## LEARNING GUIDE

### SUBJECT

**103001023 - Strategic Management & Entrepreneurship**

### DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

### ACADEMIC YEAR & SEMESTER

2022/23 - Semester 2



INTERNATIONAL  
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EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



E.T.S. de Ingenieros  
Informáticos

## Index

---

### Learning guide

1. Description.....	1
2. Faculty.....	1
3. Skills and learning outcomes .....	2
4. Brief description of the subject and syllabus.....	3
5. Schedule.....	8
6. Activities and assessment criteria.....	10
7. Teaching resources.....	12



## 1. Description

### 1.1. Subject details

<b>Name of the subject</b>	103001023 - Strategic Management & Entrepreneurship
<b>No of credits</b>	4 ECTS
<b>Type</b>	Optional
<b>Academic year of the programme</b>	First year
<b>Semester of tuition</b>	Semester 2
<b>Tuition period</b>	February-June
<b>Tuition languages</b>	English
<b>Degree programme</b>	10AM - Master Universitario en Ingeniería del Software
<b>Centre</b>	10 - Escuela Técnica Superior De Ingenieros Informáticos
<b>Academic year</b>	2022-23

## 2. Faculty

### 2.1. Faculty members with subject teaching role

<b>Name and surname</b>	<b>Office/Room</b>	<b>Email</b>	<b>Tutoring hours *</b>
Claudio Antonio Feijoo Gonzalez (Subject coordinator)		claudio.feijoo@upm.es	- -

\* 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 \*

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#### 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

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

#### 3.2. Learning outcomes

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

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

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

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





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

\* 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

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### 4.1. Brief description of the subject

#### 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.



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EXCELLENCE

PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



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Informáticos

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

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.

?

### 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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LEARNING ACTIVITIES

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## 4.2. Syllabus

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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LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



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Informáticos

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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LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



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## 5. Schedule

### 5.1. Subject schedule\*

Week	Classroom activities	Laboratory activities	Distant / On-line	Assessment activities
1	<b>Regular session in the classroom</b> Duration: 03:00 Lecture			
2	<b>Regular session in the classroom</b> Duration: 03:00 Lecture			
3				<b>Individual assignment</b> Individual work Continuous assessment Presential Duration: 03:00
4	<b>Regular session in the classroom</b> Duration: 03:00 Lecture			
5	<b>Regular session in the classroom</b> Duration: 03:00 Lecture			
6	<b>Regular session in the classroom</b> Duration: 03:00 Cooperative activities			
7				<b>Teamwork assignment</b> Group presentation Continuous assessment Presential Duration: 03:00
8	<b>Regular session in the classroom</b> Duration: 03:00 Cooperative activities			
9	<b>Regular session in the classroom</b> Duration: 03:00 Cooperative activities			
10	<b>Regular session in the classroom</b> Duration: 03:00 Cooperative activities			
11	<b>Regular session in the classroom</b> Duration: 03:00 Cooperative activities			
12	<b>Visits / guest lectures</b> Duration: 03:00 Additional activities			



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PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



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Informáticos

13	<b>Regular session in the classroom</b> Duration: 03:00 Cooperative activities			
14	<b>Regular session in the classroom</b> Duration: 03:00 Cooperative activities			
15	<b>Regular session in the classroom</b> Duration: 03:00 Cooperative activities			
16	<b>Project Mentoring</b> Duration: 04:00 Additional activities			
17				<b>Pitch. Teamwork presentation</b> Group presentation Final examination Presental Duration: 04:00  <b>Participation and contributions during classes</b> Other assessment Continuous assessment Presental Duration: 01:00

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.

\* The schedule is based on an a priori planning of the subject; it might be modified during the academic year, especially considering the COVID19 evolution.



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PR/CL/001  
COORDINATION PROCESS OF  
LEARNING ACTIVITIES

ANX-PR/CL/001-01  
LEARNING GUIDE



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Informáticos

## 6. Activities and assessment criteria

### 6.1. Assessment activities

#### 6.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
3	Individual assignment	Individual work	Face-to-face	03:00	40%	6 / 10	CG1 CG18 CE13 CG3 CG9
7	Teamwork assignment	Group presentation	Face-to-face	03:00	20%	5 / 10	CG9 CG1 CG18 CE13 CG3
17	Participation and contributions during classes	Other assessment	Face-to-face	01:00	20%	5 / 10	CG1 CG18 CE13 CG3 CG9

#### 6.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
17	Pitch. Teamwork presentation	Group presentation	Face-to-face	04:00	20%	/ 10	CG1 CG18 CE13 CG3 CG9

#### 6.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
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Compensation work - Just for the individual assignment and participation. Teamwork is not possible to be compensated	Individual work	Face-to-face	02:00	60%	6 / 10	CG3 CG9 CG1 CG18 CE13
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## 6.2. Assessment criteria

### 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



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LEARNING ACTIVITIES

ANX-PR/CL/001-01  
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## 7. Teaching resources

### 7.1. Teaching resources for the subject

Name	Type	Notes
Lecture Notes	Web resource	Notes for each session
[1] Economic Foundations of Strategy, Joseph T. Mahoney, Sage Publications Inc, 2005.	Bibliography	
[2] Osterwalder, A., Pigneur, Y., & Clark, T. (2010). Business model generation: A handbook for visionaries, game changers, and challengers. Hoboken. NJ: Wiley.	Bibliography	
[3] Blank, S., & Dorf, B. (2012). The startup owner's manual. K&S; Ranch	Bibliography	
[4] Ries, E. (2011). The lean startup: How today's entrepreneurs use continuous innovation to create radically successful businesses. Random House LLC.	Bibliography	
[5] Besanko, D., Dranove, D., Shanley, M., Schaefer, S. (2017). Economics of strategy. Wiley, 7th Ed.	Bibliography	
[8] Chesbrough, H. (2020). Open innovation results. Going beyond the hype and getting down to business. Oxford: Oxford University Press.	Bibliography	