



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

Educational Planning Course 2021-22
First and Second Semester

Computer Science and Engineering School
Universidad Politécnica de Madrid

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1 Pre-enrollment Dates

- **First period:** from 1 February to 30 June 2021
- **Second period:** from 16 November 2021 to 15 January 2022

2 Calendar



EUROPEAN MASTER IN SOFTWARE ENGINEERING

COURSE 2021-2022

First semester starts on 13 September 2021
Second semester starts on 31 January 2022

Figure 1 displays a 4x4 grid of 16 monthly calendars, arranged in four rows and four columns. Each calendar represents a month from September to April. The calendars are organized as follows:

- Row 1:** September-22, October-22, November-22, December-22
- Row 2:** January-22, February-22, March-22, April-22
- Row 3:** May-22, June-22, July-22, August-22
- Row 4:** September-22, October-22, November-22, December-22

Each calendar is a 7x7 grid with columns representing the days of the week (M, T, W, T, F, S, S) and rows representing the dates. The dates are color-coded: red for 1-5, green for 6-10, yellow for 11-15, and blue for 16-20. The grid shows the progression of the year from September to April.

Key:

- | | |
|-------------|---|
| Red | Welcome meeting for new students |
| Light green | School day |
| Yellow | Evaluation process |
| Pink | Holiday |
| Orange | Extraordinary exams |
| White | Vacation |
| Dark green | Compensation for holidays, change of schedule |

Enrollment dates:

1st and 2nd Semesters enrollment: 20 July-4 August and 6-10 September 2021

Unenrollment for 2nd Semester (max. 24 ECTS): 31 January-6 February 2022

Restricted extension of enrollment: 7-13 February 2022

NOTE: On Friday 15th October and Wednesday 10th November 2021, the classes will follow the schedule of a usual Tuesday in all courses and subjects, as a compensations for the public holidays. On Thursday 4th November 2021, the classes will follow the schedule of a usual Monday in all courses and subjects, as a compensation for the public holiday. Compensation for holidays in the Spring semester to be defined when 2022 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			Adaptive Systems		Models and Methods for Process Improvement and Assessment		Assessment Activities	
			Data Engineering					
Thursday			Management, Relationships and Communication in Working Groups		Verification and Validation		Critical Software	
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)

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

 Mandatory Subjects
 Elective Subjects

 Elective Subjects (weeks 1 to 12)
 Special Activities

4 Exam Calendar

1st and 3rd Semester (Fall Term)

JANUARY 2022							
MONDAY		TUESDAY		WEDNESDAY		THURSDAY	
17		18		19		20	
Verification and Validation	15:00	Software Metrics	15:00	Critical Software	15:00	Software Project Management	15:00
Adaptive Systems	18:00			Computer Security	18:00		
21						22	
Agile Software Development: Agile Practices and Agile Usability	15:00						
24		25		26		27	
Models and Methods for Process Improvement and Assessment	15:00	Challenges for Accessible Computing for People with Functional Diversity	15:00	Requirements Engineering	15:00	Master Thesis	10:00
Data Engineering	18:00			Management, Relationships and Communication in Working Groups	18:00		
28		29		30			

2nd Semester (Spring Term)

MAY-JUNE 2022						
MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY
30	31	1	2	3	4	5
	Software Architecture 15:00	Software Quality Management 15:00	Fundamentals of Business Administration 15:00	Software Design 15:00		
6	7	8	9	10	11	12
Agent-based Software Engineering 15:00	Experimental Software Engineering 15:00	Correctness by Construction 15:00		Master Thesis 10:00		

Extraordinary period (JUL)

JUNE-JULY 2021							
MONDAY		TUESDAY		WEDNESDAY		THURSDAY	
FRIDAY		SATURDAY		SUNDAY			
20		21		22		23	
						Software Design 15:00	
						Data Engineering 18:00	
27		28		29		30	
Verification and Validation 15:00		Agile Software Development: Agile Practices and Agile Usability 15:00		Software Metrics 15:00		Software Architecture 15:00	
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	
4		5		6		7	
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			
						8	
						Master Thesis 10:00	
						9	
						10	

5 Subject Coordinators

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Subjects for Course 2021/2022

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

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

FINAL MASTER THESIS				
Course unit name	Coordinator	Type	ECTS	Term
Master Thesis	Sira Vegas	C	30	4

Type: C - Compulsory; E - Elective

6 Subject Boards

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Evaluation Boards for Course 2021/2022

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
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
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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SUBJECT

103000482 - Requirements Engineering

DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

ACADEMIC YEAR & SEMESTER

2021/22 - Semester 1



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1. Description

1.1. Subject details

Name of the subject	103000482 - Requirements Engineering
No of credits	6 ECTS
Type	Compulsory
Academic year of the programme	First year
Semester of tuition	Semester 1
Tuition period	September-January
Tuition languages	English
Degree programme	10AM - Master Universitario en Ingeniería del Software
Centre	10 - Escuela Técnica Superior De Ingenieros Informáticos
Academic year	2021-22

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 *

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

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	Face-to-face classroom activities	Face-to-face laboratory activities	Distant / On-line	Assessment activities
1	Requirements engineering process (including agile approaches) Duration: 00:30 Lecture Course goals and methodology Duration: 00:10 Lecture Software project proposal Duration: 00:10 Additional activities Term paper proposal Duration: 00:10 Additional activities Requirement types Duration: 02:00 Cooperative activities		Requirements engineering process (including agile approaches) Duration: 00:30 Lecture Course goals and methodology Duration: 00:10 Lecture Software project proposal Duration: 00:10 Additional activities Term paper proposal Duration: 00:10 Lecture Requirement types Duration: 02:00 Cooperative activities	Identifying software requirements for an existing software application Individual work Continuous assessment Not Presential Duration: 02:00
2	Software requirements specification Duration: 01:00 Lecture Software requirements attributes (and relationship with Management) Duration: 00:30 Lecture	Tool support for requirements specification: Rational Requisite Pro Duration: 01:30 Laboratory assignments	Software requirements specification Duration: 01:00 Lecture Software requirements attributes (and relationship with Management) Duration: 00:30 Lecture Tool support for requirements specification Duration: 01:30 Laboratory assignments	Creation a requirement specification using Requisite Pro Individual work Continuous assessment Not Presential Duration: 03:00
3	Requirements validation Duration: 00:30 Lecture Requirements reviews Duration: 00:30 Lecture Perform a requirements review Duration: 01:00 Cooperative activities Other validation approaches (user manual, requirements testing) Duration: 01:00 Cooperative activities		Requirements validation Duration: 00:30 Lecture Requirements reviews Duration: 00:30 Lecture Perform a requirements review Duration: 01:00 Cooperative activities Other validation approaches (user manual, requirements testing) Duration: 01:00 Cooperative activities	Software project proposal Group work Continuous assessment Not Presential Duration: 03:00 Report the validation exercises Group work Continuous assessment Not Presential Duration: 01:00



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4	Requirements elicitation Duration: 00:30 Lecture Elicitation with interviews Duration: 00:30 Lecture Project: Conduct the elicitation of a software project using interviews Duration: 02:00 Cooperative activities		Requirements elicitation Duration: 00:30 Lecture Elicitation with interviews Duration: 00:30 Lecture Project: Conduct the elicitation of a software project using interviews Duration: 02:00 Cooperative activities	Midterm exam Written test Continuous assessment Not Presential Duration: 00:30
5	Analysis: Overview Duration: 00:20 Lecture Analysis: Weak techniques Duration: 00:20 Cooperative activities Analysis: Low-fidelity prototypes Duration: 00:20 Cooperative activities Project: Conduct a prototype evaluation Duration: 01:00 Cooperative activities	Tool support for requirements projects: IBM Doors Next Generation Duration: 01:00 Laboratory assignments	Analysis: Overview Duration: 00:20 Lecture Analysis: Weak techniques Duration: 00:20 Cooperative activities Analysis: Low-fidelity prototypes Duration: 00:20 Cooperative activities Project: Conduct a prototype evaluation Duration: 01:00 Cooperative activities Tool support for requirements projects: IBM Doors Next Generation Duration: 01:00 Laboratory assignments	Add elicitation & prototyping information to DOORS Group work Continuous assessment Not Presential Duration: 03:00 Perform checklist-based analysis using DOORS Group work Continuous assessment Not Presential Duration: 01:00
6	Elicitation: Other techniques, e.g., brainstorming, quizzes, etc. Duration: 01:00 Lecture Project: Conduct the elicitation of a software project using brainstorming, etc. Duration: 02:00 Cooperative activities		Elicitation: Other techniques, e.g., brainstorming, quizzes, etc. Duration: 01:00 Lecture Project: Conduct the elicitation of a software project using brainstorming, etc. Duration: 02:00 Cooperative activities	
7	Elicitation: Requirements workshops and focus groups Duration: 01:00 Lecture Project: Conduct the elicitation of a software project using a requirements workshop Duration: 02:00 Cooperative activities		Elicitation: Requirements workshops and focus groups Duration: 01:00 Lecture Project: Conduct the elicitation of a software project using a requirements workshop Duration: 02:00 Cooperative activities	Perform checklist-based analysis using DOORS Group work Continuous assessment Not Presential Duration: 01:00 Creation a requirement specification using DOORS Group work Continuous assessment Not Presential Duration: 04:00



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8	Analysis: Conceptual models Duration: 01:00 Cooperative activities Project: Create models for the different product perspectives (and enter them in DOORS) Duration: 02:00 Cooperative activities		Analysis: Conceptual models Duration: 01:00 Cooperative activities Project: Create models for the different product perspectives (and enter them in DOORS) Duration: 02:00 Cooperative activities	Midterm exam Written test Continuous assessment Not Presential Duration: 00:30 Report the conceptual models and the cross-checks Group work Continuous assessment Not Presential Duration: 01:00
9	Validation: High-fidelity prototype Duration: 00:20 Lecture Prepare high-fidelity prototype (each group creates the high fidelity prototype for their project proposal) Duration: 02:00 Cooperative activities Perform a reverse-prototype evaluation Duration: 00:40 Cooperative activities		Validation: High-fidelity prototype Duration: 00:20 Lecture Prepare high-fidelity prototype (each group creates the high fidelity prototype for their project proposal) Duration: 02:00 Cooperative activities Perform a reverse-prototype evaluation Duration: 00:40 Cooperative activities	Report the reverse check Group work Continuous assessment Not Presential Duration: 01:00 Creation the final version of the requirement specification using DOORS Group work Continuous assessment Not Presential Duration: 03:00
10	Early estimation Duration: 01:00 Cooperative activities Requirements management Duration: 00:30 Lecture Project: Perform A change management process Duration: 01:30 Cooperative activities		Early estimation Duration: 01:00 Cooperative activities Requirements management Duration: 00:30 Lecture Project: Perform A change management process Duration: 01:30 Cooperative activities	Term paper submission Individual work Continuous assessment Not Presential Duration: 15:00 Report the change management process Group work Continuous assessment Not Presential Duration: 01:00
11	Requirements prioritization Duration: 00:20 Lecture Triage and release planning Duration: 00:40 Lecture Project: Negotiation (/triage) and release planning Duration: 01:00 Cooperative activities		Requirements prioritization Duration: 00:20 Lecture Triage and release planning Duration: 00:40 Lecture Project: Negotiation (/triage) and release planning Duration: 01:00 Cooperative activities	Term paper presentation Individual presentation Continuous assessment Not Presential Duration: 01:00 Report the triage process Group work Continuous assessment Not Presential Duration: 01:00
12	Human aspects in Requirements Engineering Duration: 02:00 Lecture		Human aspects in Requirements Engineering Duration: 02:00 Lecture	End term exam Written test Continuous assessment Not Presential Duration: 01:00
13	Keynote: Practical experiences managing requirements Duration: 01:00 Additional activities Project: Retrospective Duration: 01:00 Cooperative activities		Keynote: Practical experiences managing requirements Duration: 01:00 Additional activities Project: Retrospective Duration: 01:00 Cooperative activities	Term paper presentation Individual presentation Continuous assessment Not Presential Duration: 01:00



14		Seminar: Model-driven engineering (parte 1) Duration: 02:00 Laboratory assignments	Seminar: Model-driven engineering (parte 1) Duration: 02:00 Laboratory assignments	Term paper presentation Individual presentation Continuous assessment Not Presential Duration: 01:00
15		Seminar: Model-driven engineering (parte 2) Duration: 02:00 Laboratory assignments	Seminar: Model-driven engineering (parte 2) Duration: 02:00 Laboratory assignments	Term paper presentation Individual presentation Continuous assessment Not Presential Duration: 01:00
16	Keynote: Artifact-driven Requirements Engineering Duration: 02:00 Additional activities		Keynote: Artifact-driven Requirements Engineering Duration: 02:00 Additional activities	Development of a simple application using MDA Group work Continuous assessment Not Presential Duration: 05:00 Term paper presentation Individual presentation Continuous assessment Not Presential Duration: 01:00
17				End term exam 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.



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6. Activities and assessment criteria

6.1. Assessment activities

6.1.1. Continuous 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	4%	3 / 10	CE5
2	Creation a requirement specification using Requisite Pro	Individual work	No Presential	03:00	5%	3 / 10	CE5
3	Software project proposal	Group work	No Presential	03:00	3%	3 / 10	CE5 CG1
3	Report the validation exercises	Group work	No Presential	01:00	3%	3 / 10	CE5
4	Midterm exam	Written test	No Presential	00:30	10%	5 / 10	CE5
5	Add elicitation & prototyping information to DOORS	Group work	No Presential	03:00	3%	3 / 10	CG1 CE5
5	Perform checklist-based analysis using DOORS	Group work	No Presential	01:00	2%	3 / 10	CG1 CE5
7	Perform checklist-based analysis using DOORS	Group work	No Presential	01:00	2%	3 / 10	CG1 CE5
7	Creation a requirement specification using DOORS	Group work	No Presential	04:00	6%	3 / 10	CG1 CE5
8	Midterm exam	Written test	No Presential	00:30	10%	5 / 10	CE5
8	Report the conceptual models and the cross-checks	Group work	No Presential	01:00	3%	3 / 10	CG1 CE5
9	Report the reverse check	Group work	No Presential	01:00	3%	3 / 10	CG1 CG3
9	Creation the final version of the requirement specification using DOORS	Group work	No Presential	03:00	6%	3 / 10	CG1 CE5
10	Term paper submission	Individual work	No Presential	15:00	10%	5 / 10	CG1 CE5 CG3
10	Report the change management process	Group work	No Presential	01:00	5%	3 / 10	CG1 CE5
11	Term paper presentation	Individual presentation	No Presential	01:00	1%	3 / 10	CE5 CG3 CG1



11	Report the triage process	Group work	No Presential	01:00	5%	3 / 10	CG1 CE5
12	End term exam	Written test	No Presential	01:00	10%	5 / 10	CE5
13	Term paper presentation	Individual presentation	No Presential	01:00	1%	3 / 10	CG1 CE5 CG3
14	Term paper presentation	Individual presentation	No Presential	01:00	1%	3 / 10	CG1 CE5 CG3
15	Term paper presentation	Individual presentation	No Presential	01:00	1%	3 / 10	CG1 CE5 CG3
16	Development of a simple application using MDA	Group work	No Presential	05:00	5%	3 / 10	CE5
16	Term paper presentation	Individual presentation	No Presential	01:00	1%	3 / 10	CG3 CG1 CE5

6.1.2. Final examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
17	End term exam	Written test	Face-to-face	05:00	100%	6.5 / 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	05:00	100%	6.5 / 10	CG1 CE5 CG3



6.2. Assessment criteria

Continuous 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.

Final exam (January)

- Students will take a single exam. This exam includes all topics (theoretical and practical) covered in the course. The preparations materials will be available at moodle.

Final exam (extraordinary session)

- See **Final Exam (January)**

7. Teaching resources

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



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SUBJECT

103000484 - Software Architecture

DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

ACADEMIC YEAR & SEMESTER

2021/22 - Semester 2

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1. Description

1.1. Subject details

Name of the subject	103000484 - Software Architecture
No of credits	4 ECTS
Type	Compulsory
Academic year of the programme	First year
Semester of tuition	Semester 2
Tuition period	February-June
Tuition languages	English
Degree programme	10AM - Master Universitario en Ingeniería del Software
Centre	10 - Escuela Técnica Superior De Ingenieros Informáticos
Academic year	2021-22

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: https://docs.google.com/spreadsheets/d/151OJcTCG8xaD5YqJ2jEigZhFAPSFK5b66kMVSOjvaso/edit#gid=0



Angelica De Antonio Jimenez	5108	angelica.deantonio@upm.es	Sin horario. The tutoring timetable is available at: https://docs.google.com/spreadsheets/d/151OJcTCG8xD5YqJ2jEigZhFAPSFK5b66kMVSOjvaso/edit#gid=0
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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

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CG18 - Capacidad de trabajar y comunicarse también en contextos internacionales

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

4.2. Learning outcomes

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

RA6 - Ability to document the software architecture

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

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

5. Brief description of the subject and syllabus

5.1. Brief description of the subject

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



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5.2. Syllabus

1. Previous Concepts on Software Architecture

- 1.1. What is Software Architecture?
- 1.2. Architectural Views
- 1.3. Software Architecture in the Development Process

2. Defining a Software Architecture

- 2.1. Quality Attributes related to Software Architecture
- 2.2. Achieving Quality Attributes through Tactics
- 2.3. Architectural Styles
- 2.4. Architectural Patterns



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6. Schedule

6.1. Subject schedule*

Week	Face-to-face classroom activities	Face-to-face laboratory activities	Distant / On-line	Assessment activities
1	Presentación Duration: 01:00 Lecture Previous concepts on Software Architecture Duration: 01:00 Lecture			
2	2.1 Quality attributes related to software architecture Duration: 01:00 Lecture Practical exercises on topics that are being explained in classroom Duration: 01:00 Cooperative activities			
3	Practical exercises on topics that are being explained in classroom Duration: 01:00 Cooperative activities 2.2 Achieving quality attributes through tactics Duration: 01:00 Lecture			Practical exercises on topics that are being explained in classroom Group work Continuous assessment Not Presential Duration: 03:00
4	2.2 Achieving quality attributes through tactics Duration: 01:00 Lecture Practical exercises on topics that are being explained in classroom Duration: 01:00 Cooperative activities			
5	1.2. Architectural views Duration: 01:00 Lecture Practical exercises on topics that are being explained in classroom Duration: 01:00 Cooperative activities			



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6	Practical exercises on topics that are being explained in classroom Duration: 01:00 Cooperative activities 2.3 Architectural styles Duration: 01:00 Lecture			
7	2.3 Architectural styles Duration: 01:00 Lecture Practical exercises on topics that are being explained in classroom Duration: 01:00 Cooperative activities			Practical exercises on topics that are being explained in classroom Group work Continuous assessment Not Presential Duration: 05:00
8	2.3 Architectural styles Duration: 01:00 Lecture Practical exercises on topics that are being explained in classroom Duration: 01:00 Cooperative activities			
9	Practical exercises on topics that are being explained in classroom Duration: 01:00 Cooperative activities 2.4 Architectural patterns Duration: 01:00 Lecture			Practical exercises on topics that are being explained in classroom Group work Continuous assessment Not Presential Duration: 05:00
10	Practical exercises on topics that are being explained in classroom Duration: 01:00 Cooperative activities 2.4 Architectural patterns Duration: 01:00 Lecture			
11	Presentations of the project proposals Duration: 01:00 Additional activities 2.4 Architectural patterns Duration: 01:00 Lecture			Project Group work Continuous assessment Not Presential Duration: 12:00
12	2.4 Architectural patterns Duration: 01:00 Lecture Practical exercises on topics that are being explained in classroom Duration: 01:00 Cooperative activities			Project Group work Continuous assessment Not Presential Duration: 20:00



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13	2.4 Architectural patterns Duration: 01:00 Lecture Practical exercises on topics that are being explained in classroom Duration: 01:00 Cooperative activities			Project Group work Continuous assessment Not Presential Duration: 20:00
14	Oral presentations of the projects Duration: 02:00 Additional activities			Project Group work Continuous assessment Not Presential Duration: 09:00
15				Exam Written test Continuous assessment Presential Duration: 02:00
16				
17				Final Exam 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.



7. Activities and assessment criteria

7.1. Assessment activities

7.1.1. Continuous 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	CE12 CG1 CG3 CG14 CG18
12	Project	Group work	No Presential	20:00	10%	5 / 10	CE12 CG1 CG3 CG14 CG18
13	Project	Group work	No Presential	20:00	10%	5 / 10	CE12 CG1 CG3 CG14 CG18
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. Final examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
17	Final Exam	Written test	Face-to-face	01:00	100%	5 / 10	CE12 CG1 CG3 CG14 CG18



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7.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Project	Individual work	Face-to-face	00:00	100%	5 / 10	CE12 CG1 CG3 CG14 CG18

7.2. Assessment criteria

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

- Practical assignments: the student will have to do some practical assignments where he/she will have 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 classroom where the preliminary results of his/her work will be summarized.

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

$$FG = 0.25 \cdot PAG + 0.25 \cdot EG + 0.5 \cdot PG \text{ if } EG \geq 4 \text{ and } PG \geq 5$$

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

Where all the grades take value between 0 and 10

When failed, in the extra exam period the final grade will be obtained from the grade of a research work or project.



8. Teaching resources

8.1. Teaching resources for the subject

Name	Type	Notes
Moodle site	Web resource	http://moodle.upm.es/titulaciones/oficiales/course/view.php?id=2835
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



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SUBJECT

103000483 - Software Design

DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

ACADEMIC YEAR & SEMESTER

2021/22 - Semester 2



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1. Description

1.1. Subject details

Name of the subject	103000483 - Software Design
No of credits	4 ECTS
Type	Compulsory
Academic year of the programme	First year
Semester of tuition	Semester 2
Tuition period	February-June
Tuition languages	English
Degree programme	10AM - Master Universitario en Ingenieria del Software
Centre	10 - Escuela Tecnica Superior De Ingenieros Informaticos
Academic year	2021-22

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
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

3.1. Recommended (passed) subjects

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

3.2. Other recommended learning outcomes

- Object Oriented Programming

4. Skills and learning outcomes *

4.1. Skills to be learned

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

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

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

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

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



CG18 - Capacidad de trabajar y comunicarse también en contextos internacionales

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

4.2. Learning outcomes

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

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

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

RA23 - Time organization capability SC13, SC14 K

RA22 - Observing capability SC13, SC14, CG10 C

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.



5. Brief description of the subject and syllabus

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.



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5.2. Syllabus

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



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6. Schedule

6.1. Subject schedule*

Week	Face-to-face classroom activities	Face-to-face laboratory activities	Distant / On-line	Assessment activities
1	Software Engineering Two-dimensional Complexity Duration: 02:00 Lecture			
2	Object Oriented Review Duration: 02:00 Lecture			
3	Workshop Duration: 02:00 Cooperative activities			
4	System Software Design Features Duration: 02:00 Lecture			
5	Workshop Duration: 02:00 Cooperative activities			
6	Workshop Duration: 02:00 Cooperative activities			Test Online test Continuous assessment Presential Duration: 00:30
7	Workshop Duration: 02:00 Cooperative activities			
8	Design and Dominion Patterns Duration: 02:00 Lecture			
9	Workshop Duration: 02:00 Cooperative activities			Test Online test Continuous assessment Presential Duration: 00:30
10	Workshop Duration: 02:00 Cooperative activities			
11	Workshop Duration: 02:00 Cooperative activities			
12	Workshop Duration: 02:00 Cooperative activities			



13	Workshop Duration: 02:00 Cooperative activities			
14	Workshop Duration: 02:00 Cooperative activities			Oral presentation of the final work Group work Continuous assessment Presential Duration: 02:00
15				
16				Final test Individual work Final examination Presential Duration: 02:00
17				

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

* 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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7. Activities and assessment criteria

7.1. Assessment activities

7.1.1. Continuous assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
6	Test	Online test	Face-to-face	00:30	20%	/ 10	CE12 CG11
9	Test	Online test	Face-to-face	00:30	25%	/ 10	CE12 CG11
14	Oral presentation of the final work	Group work	Face-to-face	02:00	55%	5 / 10	CG10 CG14 CG1 CG18 CE12 CG11 CG3

7.1.2. Final examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
16	Final test	Individual work	Face-to-face	02:00	100%	5 / 10	CG1 CG10 CG14 CG18 CE12 CG11 CG3

7.1.3. Referred (re-sit) examination

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

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

All assessment activities are mandatory.

In accordance with established standards you may opt for an evaluation only for final test. In this case they can not assess the skills related to social issues.

The evaluation by only final test will consist of a test-type exam (45%) and the development of a software system that works and meets the design criteria of the subject (55%).

8. Teaching resources

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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SUBJECT

103000486 - Models And Methods For Process Improvement And Assessments

DEGREE PROGRAMME

10AM - Master Universitario En Ingeniería Del Software

ACADEMIC YEAR & SEMESTER

2021/22 - Semester 1



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1. Description

1.1. Subject details

Name of the subject	103000486 - Models And Methods For Process Improvement And Assessments
No of credits	4 ECTS
Type	Compulsory
Academic year of the programme	First year
Semester of tuition	Semester 1
Tuition period	September-January
Tuition languages	English
Degree programme	10AM - Master Universitario en Ingeniería del Software
Centre	10 - Escuela Tecnica Superior De Ingenieros Informaticos
Academic year	2021-22

2. Faculty

2.1. Faculty members with subject teaching role

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

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.

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

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

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



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



10	Chapter 3: Process Models oriented to services Duration: 00:30 Lecture Exercise related to ITIL (statement) Duration: 00:30 Problem-solving class		Chapter 3: Process Models oriented to services Duration: 00:30 Lecture Exercise related to ITIL (statement) Duration: 00:30 Problem-solving class	Discussion/Participating in class Other assessment Continuous assessment Presential Duration: 01:00 Exercise related to ROI in a Small Enterprise Group work Continuous assessment Presential Duration: 01:00
11	Chapter 3: CMMI Duration: 02:00 Lecture		Chapter 3: CMMI Duration: 02:00 Lecture	Discussion/Participating in class Other assessment Continuous assessment Presential Duration: 01:00
12	Chapter 3: CMMI Duration: 02:00 Lecture		Chapter 3: CMMI Duration: 02:00 Lecture	Discussion/Participating in class Other assessment Continuous assessment Presential Duration: 01:00
13				Discussion/Participating in class Other assessment Continuous assessment Presential Duration: 01:30 Presentation related to a selected Service Process Individual presentation Continuous assessment Presential Duration: 01:30
14				Discussion/Participating in class Other assessment Continuous assessment Presential Duration: 01:00 Presentation related to a selected Service Process Individual presentation Continuous assessment Presential Duration: 02:00
15				
16				
17				Final Test 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.



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7. Activities and assessment criteria

7.1. Assessment activities

7.1.1. Continuous assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
1	Discussion/Participating in class	Other assessment	Face-to-face	01:00	1%	5 / 10	CG1 CG18
2	Discussion/Participating in class	Other assessment	Face-to-face	01:00	1%	5 / 10	CG1 CG18
3	Discussion/Participating in class	Other assessment	Face-to-face	01:00	1%	5 / 10	CG1 CG18 CE4 CE9 CE10
4	Discussion/Participating in class	Other assessment	Face-to-face	01:00	1%	5 / 10	CE4 CE9 CE10 CG1 CG18
4	Exercise related to ROI in Commitment	Other assessment	Face-to-face	01:00	15%	5 / 10	CG1 CG3 CG18 CE9 CE4 CG17 CE10
5	Discussion/Participating in class	Other assessment	Face-to-face	01:00	1%	5 / 10	CG1 CG18 CE9 CE10
6	Discussion/Participating in class	Other assessment	Face-to-face	01:00	1%	5 / 10	CG1 CG18 CE9 CE10
7	Discussion/Participating in class	Other assessment	Face-to-face	01:00	1%	5 / 10	CG1 CG18 CE9 CE10



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7	Exercise related to ROI in Assessment	Group work	Face-to-face	01:00	15%	5 / 10	CG1 CG3 CG18 CE9 CG17 CE10
8	Discussion/Participating in class	Other assessment	Face-to-face	01:00	1%	5 / 10	CG1 CG18 CE4 CE9 CE10
9	Discussion/Participating in class	Other assessment	Face-to-face	01:00	1%	5 / 10	CE9 CE10 CG1 CG18
9	Exercise related to ROI in Action Plans and Implementation	Group work	Face-to-face	01:00	15%	5 / 10	CG1 CG3 CG18 CE9 CG17 CE10
9	Exercise related to ROI in Summary	Group work	Face-to-face	01:00	5%	5 / 10	CG1 CG3 CG18 CE9 CE4 CG17 CE10
10	Discussion/Participating in class	Other assessment	Face-to-face	01:00	1%	5 / 10	CG18 CE10 CG1 CG3
10	Exercise related to ROI in a Small Enterprise	Group work	Face-to-face	01:00	10%	5 / 10	CG3 CG18 CG17 CG1 CE10
11	Discussion/Participating in class	Other assessment	Face-to-face	01:00	1%	5 / 10	CG1 CG3 CG18 CE10
12	Discussion/Participating in class	Other assessment	Face-to-face	01:00	1%	5 / 10	CG1 CG3 CG18 CE10
13	Discussion/Participating in class	Other assessment	Face-to-face	01:30	1.5%	5 / 10	CG1 CG3 CG18 CE9



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13	Presentation related to a selected Service Process	Individual presentation	Face-to-face	01:30	12.5%	5 / 10	CG1 CG3 CG18 CE9
14	Discussion/Participating in class	Other assessment	Face-to-face	01:00	1.5%	5 / 10	CG1 CG3 CG18 CE9
14	Presentation related to a selected Service Process	Individual presentation	Face-to-face	02:00	12.5%	5 / 10	CG18 CE9 CG1 CG3

7.1.2. Final examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
17	Final Test	Written test	Face-to-face	02:00	100%	5 / 10	CG1 CG3 CG18 CE4 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	02:00	100%	5 / 10	CG1 CG3 CG18 CE4 CG17 CE9 CE10



7.2. Assessment criteria

The assessment activities are the following:

- Attendance and Active participation of students during the classes (15%).
- Group Exercises related to Return on Investment (ROI) in Commitment (15%), Assessment (15%), Action Plans and Implementation (15%), and Summary (5%)
- Group Exercise related to ROI in a Small enterprise (10%).
- Individual research work based on a service process from ITIL (25%). This activity is divided into two ones. One related to the individual skills in communications (12.5%) and the other one related to the memory of the work itself (12.5%).

Students should have a rating greater or equal than 5.0 (over 10) to pass the subject.

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)



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CMMI Model V2.0	Bibliography	CMMI Institute, CMMI V2.1 Model, December 2018
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7.2.2 Software Project Management



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SUBJECT

103000485 - Software Project Management

DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

ACADEMIC YEAR & SEMESTER

2021/22 - Semester 1



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1. Description

1.1. Subject details

Name of the subject	103000485 - Software Project Management
No of credits	4 ECTS
Type	Compulsory
Academic year of the programme	First year
Semester of tuition	Semester 1
Tuition period	September-January
Tuition languages	English
Degree programme	10AM - Master Universitario en Ingenieria del Software
Centre	10 - Escuela Tecnica Superior De Ingenieros Informaticos
Academic year	2021-22

2. Faculty

2.1. Faculty members with subject teaching role

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

* 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

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

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

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

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

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

CG18 - Capacidad de trabajar y comunicarse también en contextos internacionales

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

CG5 - Organización y planificación

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3.2. 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	Face-to-face classroom activities	Face-to-face laboratory activities	Distant / On-line	Assessment activities
1	Chapter 1 Duration: 02:00 Cooperative activities		Chapter 1 Duration: 02:00 Cooperative activities	
2		Software Project Management Model (Lego) Duration: 02:00 Cooperative activities	Software Project Management Model (Lego) Duration: 02:00 Cooperative activities	
3	Chapter 2 Duration: 02:00 Cooperative activities	Motivational Factors in Software Development Duration: 02:00 Cooperative activities	Chapter 2 Duration: 02:00 Cooperative activities	
4	Chapter 3 Duration: 02:00 Cooperative activities		Chapter 3 Duration: 02:00 Cooperative activities	
5	Chapter 3 Duration: 02:00 Cooperative activities		Chapter 3 Duration: 02:00 Cooperative activities	
6	Chapter 4 Duration: 02:00 Cooperative activities			
7	SPM Complementary Knowledge Duration: 02:00 Cooperative activities		SPM Complementary Knowledge Duration: 02:00 Cooperative activities	
8	Chapter 5 Duration: 02:00 Cooperative activities			
9	Chapter 5 Duration: 02:00 Cooperative activities			
10	Chapter 6 Duration: 02:00 Cooperative activities			
11	Chapter 6 Duration: 02:00 Cooperative activities			
12	Chapter 6 Duration: 02:00 Cooperative activities	Software Project Management Model (Lego) Duration: 02:00 Cooperative activities	Software Project Management Model (Lego) Duration: 02:00 Cooperative activities	
13	Chapter 6 Duration: 02:00 Cooperative activities	Soft Skills Management Duration: 02:00 Cooperative activities	Soft Skills Management Duration: 02:00 Cooperative activities	



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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				
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.



6. Activities and assessment criteria

6.1. Assessment activities

6.1.1. Continuous 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. Final 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



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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

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.



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7. Teaching resources

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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SUBJECT

103000488 - Software Metrics

DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

ACADEMIC YEAR & SEMESTER

2021/22 - Semester 1

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1. Description

1.1. Subject details

Name of the subject	103000488 - Software Metrics
No of credits	4 ECTS
Type	Compulsory
Academic year of the programme	First year
Semester of tuition	Semester 1
Tuition period	September-January
Tuition languages	English
Degree programme	10AM - Master Universitario en Ingenieria del Software
Centre	10 - Escuela Tecnica Superior De Ingenieros Informaticos
Academic year	2021-22

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
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 *

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

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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5. Schedule

5.1. Subject schedule*

Week	Face-to-face classroom activities	Face-to-face laboratory activities	Distant / On-line	Assessment activities
1	Chapter 1.1 Why Measure Chapter 1.2 Measure Elements Duration: 02:00 Lecture		Chapter 1 Duration: 02:00 Lecture	
2	Chapter 2.1 Measuring Internal Product Attributes Duration: 02:00 Lecture		Chapter 2.1 Measuring Internal Product Attributes Duration: 02:00 Lecture	Quiz 1 Online test Continuous assessment Not Presential Duration: 00:30
3	Chapter 2.1 Measuring Internal Product Attributes Duration: 02:00 Lecture		Chapter 2.1 Measuring Internal Product Attributes Duration: 02:00 Lecture	Class Participation Group work Continuous assessment Presential Duration: 02:00
4	Chapter 2.2 Measuring External Product Attributes Duration: 02:00 Lecture		Chapter 2.2 Measuring External Product Attributes Duration: 02:00 Lecture	
5	Chapter 3 Measuring Process Duration: 02:00 Lecture		Chapter 3 Measuring Process Duration: 02:00 Lecture	Quiz 2 Online test Continuous assessment Not Presential Duration: 00:30
6	Chapter 4. Designing Metrics Program Duration: 02:00 Lecture		Chapter 4. Designing Metrics Program Duration: 02:00 Lecture	
7	Chapter 4. Designing Metrics Program Duration: 02:00 Lecture		Chapter 4. Designing Metrics Program Duration: 02:00 Lecture	Class Participation Group work Continuous assessment Presential Duration: 02:00
8	Chapter 4. Designing Metrics Program Duration: 02:00 Lecture		Chapter 4. Designing Metrics Program Duration: 02:00 Lecture	Initial Report Group work Continuous assessment Presential Duration: 02:00
9	Chapter 4. Designing Metrics Program Duration: 02:00 Lecture		Chapter 4. Designing Metrics Program Duration: 02:00 Lecture	Quiz 3 Online test Continuous assessment Not Presential Duration: 00:30



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10	Chapter 4. Designing Metrics Program Duration: 02:00 Lecture		Chapter 4. Designing Metrics Program Duration: 02:00 Lecture	
11	Chapter 4. Designing Metrics Program Duration: 02:00 Lecture		Chapter 4. Designing Metrics Program Duration: 02:00 Lecture	
12	Chapter 5. Frameworks for Software Measurements Duration: 02:00 Lecture		Chapter 5. Frameworks for Software Measurements Duration: 02:00 Lecture	Class Participation Group work Continuous assessment Presential Duration: 02:00 Quiz 4 Online test Continuous assessment Not Presential Duration: 00:30
13	Chapter 5. Frameworks for Software Measurements Duration: 02:00 Lecture		Chapter 5. Frameworks for Software Measurements Duration: 02:00 Lecture	
14	Chapter 6 Visualization and Decision Making with Software Measurements Duration: 02:00 Lecture		Chapter 6 Visualization and Decision Making with Software Measurements Duration: 02:00 Lecture	Final Report Group work Continuous assessment Presential Duration: 02:00
15	Chapter 6 Visualization and Decision Making with Software Measurements Duration: 01:00 Lecture		Chapter 6 Visualization and Decision Making with Software Measurements Duration: 01:00 Lecture	
16				
17				Final Test Online test Continuous assessment Not Presential Duration: 02:00 Final exam Written test Final examination Not 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.



6. Activities and assessment criteria

6.1. Assessment activities

6.1.1. Continuous 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	Class Participation	Group work	Face-to-face	02:00	2%	0 / 10	CG18
5	Quiz 2	Online test	No Presential	00:30	5%	4 / 10	CE10
7	Class Participation	Group work	Face-to-face	02:00	2%	0 / 10	CG1
8	Initial Report	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	Class Participation	Group 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	CG12 CG2 CE10
17	Final Test	Online test	No Presential	02:00	29%	5 / 10	CE10 CG2 CG18 CG1

6.1.2. Final examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
17	Final exam	Written test	No Presential	02:00	100%	5 / 10	CE10 CG2 CG12 CG18 CG1



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6.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Final Test	Written test	Face-to-face	02:00	100%	5 / 10	CG12 CG18 CG2 CE10

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 exams can be repeated in the extraordinary 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.



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



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SUBJECT

103000489 - Verification And Validation

DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

ACADEMIC YEAR & SEMESTER

2021/22 - Semester 1



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1. Description

1.1. Subject details

Name of the subject	103000489 - Verification And Validation
No of credits	6 ECTS
Type	Compulsory
Academic year of the programme	First year
Semester of tuition	Semester 1
Tuition period	September-January
Tuition languages	English
Degree programme	10AM - Master Universitario en Ingenieria del Software
Centre	10 - Escuela Tecnica Superior De Ingenieros Informaticos
Academic year	2021-22

2. Faculty

2.1. Faculty members with subject teaching role

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

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



3. Prior knowledge recommended to take the subject

3.1. Recommended (passed) subjects

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

3.2. Other recommended learning outcomes

- Programming languages C and JAVA

4. Skills and learning outcomes *

4.1. Skills to be learned

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

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

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

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

CG18 - Capacidad de trabajar y comunicarse también en contextos internacionales



CG19 - Aproximación sistemática a la gestión de riesgos

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

4.2. Learning outcomes

RA12 - Knows and applies product and process quality control techniques

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

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

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

5. Brief description of the subject and syllabus

5.1. Brief description of the subject

No hay descripción de la asignatura.

5.2. Syllabus

1. Introduction

1.1. Introduction to V&V

1.2. V&V and the software development process

1.3. V&V and the software development products

2. 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



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3.2. Testing levels

3.3. The testing process

3.4. Software verification and validation plan

3.5. Testing tools



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6. Schedule

6.1. Subject schedule*

Week	Face-to-face classroom activities	Face-to-face laboratory activities	Distant / On-line	Assessment activities
1	Course introduction Duration: 01:00 Lecture Static evaluation Duration: 01:00 Lecture Introduction to software testing Duration: 02:00 Lecture		Course introduction Duration: 01:00 Lecture Static evaluation Duration: 01:00 Lecture Introduction to software testing Duration: 02:00 Lecture	
2	Static evaluation Duration: 02:00 Lecture Testing Duration: 02:00 Lecture		Static evaluation Duration: 02:00 Lecture Testing Duration: 02:00 Lecture	
3	Testing Duration: 02:00 Lecture		Testing Duration: 02:00 Lecture	Static techniques exercise Individual work Continuous assessment Presential Duration: 02:00
4	Static evaluation Duration: 01:00 Lecture Static evaluation Duration: 01:00 Problem-solving class Testing Duration: 02:00 Problem-solving class		Static evaluation Duration: 01:00 Lecture Static evaluation Duration: 01:00 Problem-solving class Testing Duration: 02:00 Problem-solving class	
5	Static evaluation Duration: 01:00 Lecture Static evaluation Duration: 01:00 Problem-solving class		Static evaluation Duration: 01:00 Lecture Static evaluation Duration: 01:00 Problem-solving class	White box exercise Individual work Continuous assessment Presential Duration: 02:00
6	Static evaluation Duration: 01:00 Lecture Static evaluation Duration: 01:00 Problem-solving class Testing		Static evaluation Duration: 01:00 Lecture Static evaluation Duration: 01:00 Problem-solving class Testing	



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	Duration: 02:00 Lecture		Duration: 02:00 Lecture	
7	Testing Duration: 02:00 Problem-solving class		Testing Duration: 02:00 Problem-solving class	
8				Black box exercise Individual work Continuous assessment Presential Duration: 02:00
9	Testing Duration: 02:00 Lecture		Testing Duration: 02:00 Lecture	
10	Testing Duration: 02:00 Problem-solving class		Testing Duration: 02:00 Problem-solving class	
11				Assignment: testing a software system Individual work Continuous assessment Presential Duration: 02:00
12	Testing: follow-up of assignment Duration: 02:00 Cooperative activities		Testing: follow-up of assignment Duration: 02:00 Cooperative activities	
13	Testing: follow-up of assignment Duration: 02:00 Cooperative activities		Testing: follow-up of assignment Duration: 02:00 Cooperative activities	
14				Assignment: testing a software system Individual work Continuous assessment Presential Duration: 02:00 Static techniques presentation Individual work Continuous assessment Presential Duration: 02:00
15				Student's attitude regarding lectures and course in general Other assessment Continuous assessment Presential Duration: 02:00
16				
17				Final exam 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.



7. Activities and assessment criteria

7.1. Assessment activities

7.1.1. Continuous assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
3	Static techniques exercise	Individual work	Face-to-face	02:00	10%	/ 10	CE8 CE7 CG12
5	White box exercise	Individual work	Face-to-face	02:00	10%	/ 10	CG12 CE8 CE7
8	Black box exercise	Individual work	Face-to-face	02:00	10%	/ 10	CE8 CE7 CG12
11	Assignment: testing a software system	Individual work	Face-to-face	02:00	20%	/ 10	CE8 CE7 CG4 CG18 CG1 CG19
14	Assignment: testing a software system	Individual work	Face-to-face	02:00	20%	/ 10	CE8 CE7 CG4 CG18 CG1 CG19
14	Static techniques presentation	Individual work	Face-to-face	02:00	20%	/ 10	CE8 CE7 CG4 CG12 CG18 CG1 CG19
15	Student's attitude regarding lectures and course in general	Other assessment	Face-to-face	02:00	10%	0 / 10	CE7 CE8

7.1.2. Final examination



Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
17	Final exam	Written test	Face-to-face	02:00	100%	5 / 10	CG12 CE7 CE8 CG18 CG19 CG1 CG4

7.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Students who have followed the "continuous evaluation" mode, will have to re-submit all assignments that have not reached the minimum score required. The attitude score will be taken from the regular period.	Individual work	Face-to-face	04:00	100%	5 / 10	CE7 CE8 CG18 CG19 CG1 CG4 CG12
Students who have followed the "final test" evaluation mode will have to perform an exam.	Written test	Face-to-face	02:00	100%	5 / 10	CE8 CG18 CG12 CE7 CG19 CG1 CG4



7.2. Assessment criteria

Continuous evaluation mode:

The score of the course is calculated regarding the performance of the student in the different tasks that (s)he has been assigned:

- Two exercises applying static techniques to a program (15% of the score each exercise).
- Exercise applying white box techniques to a program (10% of the score).
- Exercise applying black box techniques to a program (10% of the score).
- Assignment performing testing on a software system (40% of the score).

It will also be taken into consideration for the score of the course the participation and attitude of the student during the lectures and regarding the course in general (10%).

Students who fail to submit any of the evaluation tasks (exercises or assignments) will automatically fail the course.

Final exam evaluation mode:

The score of the course is calculated based on the score of the final exam.

Extraordinary evaluation:

Students who have followed the continuous evaluation mode will have to re-submit all evaluation tasks that do not reach the minimum score required. The attitude score will be taken from the regular period.

Students who have followed the final exam evaluation mode will have to repeat the final exam.



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



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SUBJECT

103000487 - Software Quality Management

DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

ACADEMIC YEAR & SEMESTER

2021/22 - Semester 2

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1. Description

1.1. Subject details

Name of the subject	103000487 - Software Quality Management
No of credits	4 ECTS
Type	Compulsory
Academic year of the programme	First year
Semester of tuition	Semester 2
Tuition period	February-June
Tuition languages	English
Degree programme	10AM - Master Universitario en Ingenieria del Software
Centre	10 - Escuela Tecnica Superior De Ingenieros Informaticos
Academic year	2021-22

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Angelica De Antonio Jimenez (Subject coordinator)	3354	angelica.deantonio@upm.es	W - 10:30 - 14:00 Th - 09:30 - 12:00 Previous appointment should be requested at angelica.deantonio@upm.es



Jaime Ramirez Rodriguez	5112	jaime.ramirez@upm.es	M - 16:00 - 18:00 Tu - 16:00 - 18:00 Th - 16:00 - 18:00 Previous appointment is recommended
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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

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

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

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

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

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



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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

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?



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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



5. Schedule

5.1. Subject schedule*

Week	Face-to-face classroom activities	Face-to-face laboratory activities	Distant / On-line	Assessment activities
1	Chapter 1.1. Software Quality Definition Duration: 02:00 Lecture			Reading 1 test Online test Continuous assessment and final examination Not Presential Duration: 03:00
2	Chapter 1.2 Software Quality Models Duration: 02:00 Lecture			
3	Chapter 1.2 Software Quality Models Chapter 1.3 Usage of a Quality Model Duration: 02:00 Lecture			Individual exercise on quality attributes Individual work Continuous assessment and final examination Not Presential Duration: 04:00
4	Chapter 1.4 Defects and Defect Density Duration: 02:00 Lecture			Reading 2 test Online test Continuous assessment and final examination Not Presential Duration: 03:00
5	Chapter 2.1 Static Controls Duration: 02:00 Lecture			Report on defect tracking tools Group work Continuous assessment and final examination Not Presential Duration: 06:00
6		Exercise on inspections Duration: 02:00 Laboratory assignments		
7		Exercise on walkthroughs Duration: 02:00 Laboratory assignments		Report about exercise on inspections Group work Continuous assessment Not Presential Duration: 02:00
8	Chapter 2.2 Dynamic Controls Duration: 02:00 Lecture			Report about exercise on walkthroughs Individual work Continuous assessment Not Presential Duration: 02:00
9	Chapter 2.2 Dynamic Controls Duration: 02:00 Lecture			Reading 3 test Online test Continuous assessment and final examination Not Presential Duration: 03:00



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10	Chapter 3.1 Product and Process Quality Metrics Chapter 3.2 Comparison of Quality Control Activities Duration: 01:00 Lecture			First Partial exam Written test Continuous assessment Presential Duration: 01:00
11	Chapter 4.1 Introduction to Quality Management and related standards and norms Chapter 4.2 The Quality System and the Quality Manual Duration: 02:00 Lecture			
12	Chapter 4.3 Quality Management Tools Chapter 4.4 The Cost of Quality Duration: 02:00 Lecture			Reading 4 test Online test Continuous assessment and final examination Not Presential Duration: 03:00
13	Chapter 5.1 Introduction to Quality Assurance Chapter 5.2 Quality Construction s Chapter 5.3 Quality Assurance Planning Duration: 01:00 Lecture Chapter 6.1 Basic Concepts of Software Configuration Management Chapter 6.2 Configuration Identification Duration: 01:00 Lecture	Group work on quality management tools Duration: 03:00 Cooperative activities		
14		Group work on quality management tools Duration: 03:00 Cooperative activities		Presentation of group work on quality management tools Group presentation Continuous assessment Presential Duration: 02:00
15	Chapter 6.3 Configuration Change Control Chapter 6.4 Configuration State Reports Chapter 6.5 Configuration Audits Chapter 6.6 Configuration Management Plan Duration: 02:00 Lecture			Reading 5 test Online test Continuous assessment and final examination Not Presential Duration: 03:00
16				
17				Second partial exam Written test Continuous assessment Presential Duration: 02:00 Final exam 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,



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especially considering the COVID19 evolution.



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6. Activities and assessment criteria

6.1. Assessment activities

6.1.1. Continuous assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
1	Reading 1 test	Online test	No Presential	03:00	3%	/ 10	CG12
3	Individual exercise on quality attributes	Individual work	No Presential	04:00	7%	/ 10	CG19
4	Reading 2 test	Online test	No Presential	03:00	3%	/ 10	CG12
5	Report on defect tracking tools	Group work	No Presential	06:00	10%	/ 10	CG12 CG18 CG1 CE11 CG2 CG3
7	Report about exercise on inspections	Group work	No Presential	02:00	10%	/ 10	CG2 CG3 CG18 CG1
8	Report about exercise on walkthroughs	Individual work	No Presential	02:00	8%	/ 10	CE7 CG12 CE1
9	Reading 3 test	Online test	No Presential	03:00	3%	/ 10	CG12 CE1
10	First Partial exam	Written test	Face-to-face	01:00	20%	4 / 10	CE6 CE7 CE1
12	Reading 4 test	Online test	No Presential	03:00	3%	/ 10	CG12 CE1
14	Presentation of group work on quality management tools	Group presentation	Face-to-face	02:00	10%	/ 10	CG3 CG18 CG19 CE1
15	Reading 5 test	Online test	No Presential	03:00	3%	/ 10	CG12
17	Second partial exam	Written test	Face-to-face	02:00	20%	4 / 10	CE6 CE7 CG12 CG1 CG19 CE1 CE11

6.1.2. Final examination



Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
1	Reading 1 test	Online test	No Presential	03:00	3%	/ 10	CG12
3	Individual exercise on quality attributes	Individual work	No Presential	04:00	7%	/ 10	CG19
4	Reading 2 test	Online test	No Presential	03:00	3%	/ 10	CG12
5	Report on defect tracking tools	Group work	No Presential	06:00	10%	/ 10	CG12 CG18 CG1 CE11 CG2 CG3
9	Reading 3 test	Online test	No Presential	03:00	3%	/ 10	CG12 CE1
12	Reading 4 test	Online test	No Presential	03:00	3%	/ 10	CG12 CE1
15	Reading 5 test	Online test	No Presential	03:00	3%	/ 10	CG12
17	Final exam	Written test	Face-to-face	02:00	68%	5 / 10	CE6 CG2 CE7 CG3 CG12 CG1 CG19 CE1 CE11

6.1.3. Referred (re-sit) examination

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	12%	/ 10	CG12 CG1



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Individual and group exercises	Individual work	Face-to-face	00:00	48%	/ 10	CG2 CG3 CG12 CG18 CG1 CG19 CE11
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6.2. Assessment criteria

The subject is marked following continuous assessment.

The student passes the subject only if 5 or more points on 10 are obtained at the end of the course, regarding the following criteria:

FINAL GRADE = 45% Individual and group exercises in the classroom and Moodle + 15% Reading tests in Moodle + 40% Exams

The maximum grade for each of these components and the minimum mark 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 (and correspondence over the final grade)
Individual and group exercises in the classroom and Moodle (45%)	10 (4,5)	-
Reading tests (15%)	10 (1,5)	-
Exams (40%)	10 (4,0)	4 (1,6)
Student participation (10%)	10 (1,0)	-

When failed, the exams can be repeated in the extraordinary 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.



The grade for individual and group exercises, and for reading tests, if they are delivered past the established deadline, will suffer a reduction which is proportional to the delay.

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



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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
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	http://videos.asq.org/the-how-and-why-of-auditing
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	https://moodle.upm.es/titulaciones/oficiales/course/view.php?id=2999

7.4 Advanced Software Engineering Aspects Module

7.4.1 Agile Software Development: Agile Practices and Agile Usability



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SUBJECT

103000545 - Agile Software Development: Agile Practices And Agile Usability

DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

ACADEMIC YEAR & SEMESTER

2021/22 - Semester 1

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1. Description

1.1. Subject details

Name of the subject	103000545 - Agile Software Development: Agile Practices And Agile Usability
No of credits	4 ECTS
Type	Optional
Academic year of the programme	First year
Semester of tuition	Semester 1
Tuition period	September-January
Tuition languages	English
Degree programme	10AM - Master Universitario en Ingeniería del Software
Centre	10 - Escuela Tecnica Superior De Ingenieros Informaticos
Academic year	2021-22

2. Faculty

2.1. Faculty members with subject teaching role

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

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



3. Skills and learning outcomes *

3.1. Skills to be learned

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

CG18 - Capacidad de trabajar y comunicarse también en contextos internacionales

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

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

3.2. Learning outcomes

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

4.1. Brief description of the subject

This subjects 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



5. Schedule

5.1. Subject schedule*

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



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14	Unit 5. Agile UX Project Duration: 02:00 Cooperative activities		Unit 5. Agile UX Project Duration: 02:00 Cooperative activities	Presentation of Project Group work Continuous assessment Presential Duration: 00:30
15	Unit 5. Agile UX Project Duration: 02:00 Cooperative activities		Unit 5. Agile UX Project Duration: 02:00 Cooperative activities	Presentation of Project Individual presentation Final examination Presential Duration: 00:30 Presentation of Project Group work Continuous assessment Presential Duration: 00:30
16				Description of the Project Report Group work Continuous assessment and final examination Not Presential Duration: 00:00 Active Participation of Students Other assessment Continuous assessment and final examination Not Presential Duration: 00:00
17				

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

* 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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6. Activities and assessment criteria

6.1. Assessment activities

6.1.1. Continuous assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
12	Presentation of Project	Group work	Face-to-face	00:30	10%	5 / 10	CE13 CG18 CG9 CG3
13	Presentation of Project	Group work	Face-to-face	00:30	10%	5 / 10	CG18 CG9 CG3 CE13
14	Presentation of Project	Group work	Face-to-face	00:30	10%	5 / 10	CE13 CG18 CG9 CG3
15	Presentation of Project	Group work	Face-to-face	00:30	10%	5 / 10	CE13 CG18 CG9 CG3
16	Description of the Project Report	Group work	No Presential	00:00	50%	5 / 10	CG18 CG9 CG3 CE13
16	Active Participation of Students	Other assessment	No Presential	00:00	10%	0 / 10	CE13 CG18 CG9 CG3

6.1.2. Final examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
15	Presentation of Project	Individual presentation	Face-to-face	00:30	40%	5 / 10	CE13 CG18 CG9 CG3



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16	Description of the Project Report	Group work	No Presential	00:00	50%	5 / 10	CG18 CG9 CG3 CE13
16	Active Participation of Students	Other assessment	No Presential	00:00	10%	0 / 10	CE13 CG18 CG9 CG3

6.1.3. Referred (re-sit) examination

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

6.2. Assessment criteria

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 each of the two 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.



7. Teaching resources

7.1. Teaching resources for the subject

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

7.4.2 Challenges for Accessible Computing for People with Functional Diversity



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SUBJECT

103000603 - Challenges For Accessible Computing For People With Functional Diversity

DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

ACADEMIC YEAR & SEMESTER

2021/22 - Semester 1



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1. Description

1.1. Subject details

Name of the subject	103000603 - Challenges For Accessible Computing For People With Functional Diversity
No of credits	4 ECTS
Type	Optional
Academic year of the programme	First year
Semester of tuition	Semester 1
Tuition period	September-January
Tuition languages	English
Degree programme	10AM - Master Universitario en Ingeniería del Software
Centre	10 - Escuela Tecnica Superior De Ingenieros Informaticos
Academic year	2021-22

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
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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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

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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4. Cognitive Accessibility

4.1. Introduction to the Easy-to-Read Methodology



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5. Schedule

5.1. Subject schedule*

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



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



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13				
14	Chapter 4: Cognitive Accessibility Duration: 01:45 Lecture		Chapter 4: Cognitive Accessibility Duration: 01:45 Lecture	Cognitive accessibility evaluation Other assessment Continuous assessment Presential Duration: 00:15
15	Classroom tutoring. Exercise 3 Duration: 02:00 Additional activities		Classroom tutoring. Exercise 3 Duration: 02:00 Additional activities	Delivery of exercise 4 Group presentation Continuous assessment Presential Duration: 00:00
16				Presentation of exercise 3 Group presentation Continuous assessment and final examination Not Presential Duration: 02:00 Delivery of exercise 3 Group work Continuous assessment Not Presential Duration: 00:00
17				Test 1 Written test Final examination Not Presential Duration: 00:30 Test 2 Written test Continuous assessment and final examination Not Presential Duration: 00:30 Delivery of exercise 1 Group work Final examination Not Presential Duration: 00:00 Delivery of exercise 2 Group work Final examination Not Presential Duration: 00:00 Delivery of exercise 3 Group work Final examination Not Presential Duration: 00:00 Delivery of exercise 4 Group presentation Final examination Presential Duration: 00:00

Depending on the programme study plan, total values will be calculated according to the ECTS credit unit as 26/27



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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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6. Activities and assessment criteria

6.1. Assessment activities

6.1.1. Continuous 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	00:45	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	
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	
8	One accessibility standard evaluation	Other assessment	Face-to-face	00:30	1%	/ 10	CE14
10	Delivery of exercise 2	Group work	No Presential	00:00	15%	/ 10	
10	State of the art in ICT accessibility evaluation	Other assessment	Face-to-face	00:10	1%	/ 10	CG13 CE14 CE13
11	Participation in evaluation of exercise 2	Individual presentation	Face-to-face	02:00	5%	/ 10	CE14
12	Cognitive accessibility evaluation	Other assessment	Face-to-face	00:15	1%	/ 10	CG13
14	Cognitive accessibility evaluation	Other assessment	Face-to-face	00:15	1%	/ 10	CG13
15	Delivery of exercise 4	Group presentation	Face-to-face	00:00	10%	/ 10	



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16	Presentation of exercise 3	Group presentation	No Presential	02:00	10%	/ 10	CG13 CE14 CE13
16	Delivery of exercise 3	Group work	No Presential	00:00	10%	/ 10	
17	Test 2	Written test	No Presential	00:30	10%	/ 10	CG13 CE14

6.1.2. Final 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
16	Presentation of exercise 3	Group presentation	No Presential	02:00	10%	/ 10	CG13 CE14 CE13
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	CE13 CG13 CE14
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	CE14
Delivery of exercise 2	Individual work	Face-to-face	00:00	20%	/ 10	CE14
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



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Delivery of exercise 4	Individual work	Face-to-face	00:00	15%	/ 10	CG13
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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; there is going to be assessment of the performance of the collaborative learning sessions that will be part of the study of accessibility standards; 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 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. The dates for the publication of grades and the ulterior exam revision will be notified as part of the corresponding exam. The exam revision will be made based on prior enquiries made by the students.

a) Continuous evaluation

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



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b) Non-continuous evaluation

In the case of non-continuous evaluation, there will be two theory exams in the same time period as the one defined for continuous evaluation. The four exercises have to be delivered in the same time period as the one defined for continuous evaluation. The student will also have to attend the two collaborative sessions (One accessibility standard evaluation) described.

c) Extraordinary evaluation period (July)

In the extraordinary evaluation period the theory tests will be repeated and the pending exercises can be delivered again. The participation in collaborative learning and in-class activities will not be re-assessed, so the grades received previously will be reused.

The grades obtained will apply the same weights as described for continuous evaluation.

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	Bibliography	Krug, S. New Riders, 3rd edition ISBN: 978-0321965516, Jan. 2014
The Principles of Universal Design	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. Abril 1997. http://www.ncsu.edu/ncsu/design/cud/about_ud/udprinciples.htm



Information technology -- User interface accessibility -- Part 1: User accessibility needs	Bibliography	International Organization for Standardization (ISO), International Electrotechnical Commission (IEC). ISO/IEC 29138-1:2018. (Technical report ISO/IEC TR 29138-1, 2009, can be accessed at http://jtc1access.org/TR29138.htm)
El modelo de la diversidad. La Bioética y los Derechos Humanos como herramientas para alcanzar la plena dignidad en la diversidad funcional	Bibliography	Palacios, A.; Romañach, J. Ediciones Diversitas, ISBN: 8496474402, 2007.
A Web for Everyone. Designing accessible user experiences	Bibliography	Horton, S.; Quesenbery, W. Rosenfeld. 2014.
SIDAR	Web resource	Fundación Sidar - Acceso Universal: http://www.sidar.org , España. 2019

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).

Classroom activities in academic year 2021-22

The current COVID-19 pandemic situation restricts the capacity of the classrooms in the School. Depending on the number of enrolled students it might be necessary to split the class in two groups that will come to the School in alternate days. The School classrooms have teleconference equipment that enables remote participation in the class. In this situation some students will be in the classroom (column "Distant / On-line" in the schedule) and other students will connect remotely (column "face-to-face" in the schedule).

If the pandemic situation improves and the University is allowed to use the classrooms at their full capacity, then all students will be able to attend the face to face sessions together.

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And in the improbable situation of a worsening of the pandemic situation, all classes would be online.

Sustainable development goals (SDGs)

The goal of this course is to learn about assistive products, that enable 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 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



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SUBJECT

103000540 - Critical Software

DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

ACADEMIC YEAR & SEMESTER

2021/22 - Semester 1

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1. Description

1.1. Subject details

Name of the subject	103000540 - Critical Software
No of credits	4 ECTS
Type	Optional
Academic year of the programme	First year
Semester of tuition	Semester 1
Tuition period	September-January
Tuition languages	English
Degree programme	10AM - Master Universitario en Ingeniería del Software
Centre	10 - Escuela Técnica Superior De Ingenieros Informáticos
Academic year	2021-22

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
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 *

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

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



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5. Schedule

5.1. Subject schedule*

Week	Face-to-face classroom activities	Face-to-face laboratory activities	Distant / On-line	Assessment activities
1	Lecture/workshop on topics 1.1 and 1.2 Duration: 02:00 Cooperative activities		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		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		Lecture/workshop on topic 1.4 Duration: 02:00 Cooperative activities	
4	Lecture/workshop on topic 1.5 Duration: 02:00 Cooperative activities		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		Lecture/workshop on topic 2.1 Duration: 02:00 Cooperative activities	
6	Lecture/workshop on topic 2.2 Duration: 02:00 Cooperative activities		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		Lecture/workshop on topic 2.3 Duration: 02:00 Cooperative activities	
8	Lecture/workshop on topic 2.4 Duration: 02:00 Cooperative activities		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		Lecture/workshop on topic 3.1 Duration: 02:00 Cooperative activities	
10	Lecture/workshop on topic 3.2 Duration: 02:00 Cooperative activities		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



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11	Lecture/workshop on topic 3.3 Duration: 02:00 Cooperative activities		Lecture/workshop on topic 3.3 Duration: 02:00 Cooperative activities	
12	Lecture/workshop on topic 3.4 Duration: 02:00 Cooperative activities		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		Lecture/workshop on topic 4.1 Duration: 02:00 Cooperative activities	
14	Lecture/workshop on topics 4.2 Duration: 02:00 Cooperative activities		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		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				Examen final 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.



6. Activities and assessment criteria

6.1. Assessment activities

6.1.1. Continuous 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. Final examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
17	Examen final	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

7.1. Teaching resources for the subject

Name	Type	Notes
Bibliografía	Bibliography	Bibliografía available in: https://www.mendeley.com/community/critical-sw

8. Other information

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 created by the evolution of the COVID-19 situation.

7.4.4 Data Engineering



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SUBJECT

103000541 - Data Engineering

DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

ACADEMIC YEAR & SEMESTER

2021/22 - Semester 1



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1. Description

1.1. Subject details

Name of the subject	103000541 - Data Engineering
No of credits	4 ECTS
Type	Optional
Academic year of the programme	First year
Semester of tuition	Semester 1
Tuition period	September-January
Tuition languages	English
Degree programme	10AM - Master Universitario en Ingenieria del Software
Centre	10 - Escuela Tecnica Superior De Ingenieros Informaticos
Academic year	2021-22

2. Faculty

2.1. Faculty members with subject teaching role

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

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



3. Prior knowledge recommended to take the subject

3.1. Recommended (passed) subjects

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

3.2. Other recommended learning outcomes

- Artificial Intelligence
- Statistics

4. Skills and learning outcomes *

4.1. Skills to be learned

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)

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

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

RA21 - Listening capability SC13, SC14, CG10 A

RA22 - Observing capability SC13, SC14, CG10 C

RA23 - Time organization capability SC13, SC14 K

RA26 - Group work skill SC13, SC14, CG17 A

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.

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.



5. Brief description of the subject and syllabus

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 Modeler tool

Topics:

Data Engineering, Data Mining, Business Intelligence

CRISP-DM, or the Data Mining Process

Techniques:

- Classification
- Regression
- Association
- Clustering



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5.2. Syllabus

1. INTRODUCTION TO DATA ENGINEERING
2. THE TOOL: IBM SPSS MODELER
3. THE PROCESS CRISP-DM
4. LINER REGRESSION
5. LOGISTIC REGRESSION
6. RFM ANALYSIS
7. DECISION TREES
8. NEURAL NETWORKS
9. CLUSTERING
10. NEAREST NEIGHBOR
11. ASSOCIATION RULES



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6. Schedule

6.1. Subject schedule*

Week	Face-to-face classroom activities	Face-to-face laboratory activities	Distant / On-line	Assessment activities
1	INTRODUCTION TO DATA ENGINEERING Duration: 02:00 Lecture		INTRODUCTION TO DATA ENGINEERING Duration: 02:00 Lecture	
2	THE PROCESS OF DATA MINING Duration: 01:00 Lecture		Tema 2 Duration: 01:00 Problem-solving class THE PROCESS OF DATA MINING Duration: 01:00 Lecture	
3	Data Understanding and Data Preparation with IBM SPSS Modeler I Duration: 01:00 Problem-solving class		Data Understanding and Data Preparation with IBM SPSS Modeler I Duration: 02:00 Problem-solving class	
4	Data Understanding and Data Preparation with IBM SPSS Modeler II Duration: 01:00 Problem-solving class		Data Understanding and Data Preparation with IBM SPSS Modeler II Duration: 02:00 Problem-solving class	
5	LINEAR REGRESSION Duration: 01:00 Lecture		LINEAR REGRESSION Duration: 02:00 Problem-solving class LINEAR REGRESSION Duration: 01:00 Lecture	
6	Modeling with IBM SPSS Modeler I Duration: 01:00 Problem-solving class		Modeling with IBM SPSS Modeler I Duration: 02:00 Problem-solving class	ASSIGNMENT 1 Group work Continuous assessment and final examination Not Presential Duration: 02:00
7	LOGISTIC REGRESSION Duration: 01:00 Lecture		LOGISTIC REGRESSION Duration: 02:00 Problem-solving class LOGISTIC REGRESSION Duration: 01:00 Lecture	
8	Modeling with IBM SPSS Modeler II Duration: 01:00 Problem-solving class		Modeling with IBM SPSS Modeler II Duration: 02:00 Problem-solving class	ASSIGNMENT 2 Group work Continuous assessment and final examination Presential Duration: 02:00



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9	DECISION TREES Duration: 01:00 Lecture		DECISION TREES Duration: 02:00 Problem-solving class DECISION TREES Duration: 01:00 Lecture	
10	RFM ANALYSIS Duration: 01:00 Lecture		RFM ANALYSIS Duration: 02:00 Problem-solving class RFM ANALYSIS Duration: 01:00 Lecture	
11	NEURAL NETWORKS Duration: 01:00 Lecture		NEURAL NETWORKS Duration: 02:00 Problem-solving class NEURAL NETWORKS Duration: 01:00 Lecture	ASSIGNMENT 3 Group work Continuous assessment and final examination Presential Duration: 02:00
12	CLUSTERING Duration: 01:00 Lecture		CLUSTERING Duration: 02:00 Problem-solving class CLUSTERING Duration: 01:00 Lecture	
13	NEAREST NEIGHBOR Duration: 01:00 Lecture		NEAREST NEIGHBOR Duration: 02:00 Problem-solving class NEAREST NEIGHBOR Duration: 01:00 Lecture	
14	ASSOCIATION RULES Duration: 01:00 Lecture		ASSOCIATION RULES Duration: 02:00 Problem-solving class ASSOCIATION RULES Duration: 01:00 Lecture	ASSIGNMENT 4 Group work Continuous assessment and final examination Presential Duration: 02:00
15				
16			Tema 3.4 Duration: 01:00 Problem-solving class	ASSIGNMENT 5 Group work Continuous assessment and final examination Presential Duration: 02:00
17				FINAL PROJECT Individual presentation Continuous assessment and 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.



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* 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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7. Activities and assessment criteria

7.1. Assessment activities

7.1.1. Continuous assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
6	ASSIGNMENT 1	Group work	No Presential	02:00	10%	5 / 10	CG7 E CG9 CG3 CG1 CG8
8	ASSIGNMENT 2	Group work	Face-to-face	02:00	10%	5 / 10	CG8 CG9 CG3 CG7 E CG1
11	ASSIGNMENT 3	Group work	Face-to-face	02:00	10%	5 / 10	CG8 CG9 CG3 CG7 E CG1
14	ASSIGNMENT 4	Group work	Face-to-face	02:00	10%	5 / 10	CG8 CG9 CG3 CG7 E CG1
16	ASSIGNMENT 5	Group work	Face-to-face	02:00	10%	5 / 10	CG8 CG9 CG3 CG1 CG7 E
17	FINAL PROJECT	Individual presentation	Face-to-face	02:00	50%	5 / 10	CG8 CG9 CG3 CG7 E CG1

7.1.2. Final examination



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Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
6	ASSIGNMENT 1	Group work	No Presential	02:00	10%	5 / 10	CG7 E CG9 CG3 CG1 CG8
8	ASSIGNMENT 2	Group work	Face-to-face	02:00	10%	5 / 10	CG8 CG9 CG3 CG7 E CG1
11	ASSIGNMENT 3	Group work	Face-to-face	02:00	10%	5 / 10	CG8 CG9 CG3 CG7 E CG1
14	ASSIGNMENT 4	Group work	Face-to-face	02:00	10%	5 / 10	CG8 CG9 CG3 CG7 E CG1
16	ASSIGNMENT 5	Group work	Face-to-face	02:00	10%	5 / 10	CG8 CG9 CG3 CG1 CG7 E
17	FINAL PROJECT	Individual presentation	Face-to-face	02:00	50%	5 / 10	CG8 CG9 CG3 CG7 E CG1

7.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
FINAL PROJECT AND ASSIGNMENTS	Individual presentation	Face-to-face	02:02	100%	5 / 10	CG8 CG9 CG3 CG7 E CG1



7.2. Assessment criteria

The evaluation is based on the assignments and the final project.

Assignments and projects will be performed individually or by groups, depending on the size of the course

To pass the course it is mandatory to present all the assignments and the final project, in any modality of evaluation

Participation in class would give a 10% increase in the final score.

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



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Ian Witten, Eibe Frank, Mark Hall, Data Mining: Practical Machine Learning Tools and Techniques, 3rd Edition, Morgan Kaufmann, ISBN 978-0-12-374856-0, 2011.	Bibliography	
Página web de la asignatura en moodle	Web resource	
IBM SPSS MODELER	Others	THE TOOL WE WILL USE
Sala de trabajo en grupo con ordenadores	Equipment	
aula	Equipment	

9. Other information

9.1. Other information about the subject

We will use Teams for communication and collaboration

7.4.5 Management, Relationships and Communication in Working Groups



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SUBJECT

103000544 - Management, Relationships And Communication In Working Groups

DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

ACADEMIC YEAR & SEMESTER

2021/22 - Semester 1

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1. Description

1.1. Subject details

Name of the subject	103000544 - Management, Relationships And Communication In Working Groups
No of credits	4 ECTS
Type	Optional
Academic year of the programme	First year
Semester of tuition	Semester 1
Tuition period	September-January
Tuition languages	English
Degree programme	10AM - Master Universitario en Ingeniería del Software
Centre	10 - Escuela Técnica Superior De Ingenieros Informáticos
Academic year	2021-22

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 *

4.1. Skills to be learned

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

CG18 - Capacidad de trabajar y comunicarse también en contextos internacionales

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

4.2. Learning outcomes

RA24 - Conflict solving capability SC13, SC14, CG18 C

RA26 - Group work skill SC13, SC14, CG17 A

RA27 - Negotiation skill SC13, SC14, CG18 C

RA21 - Listening capability SC13, SC14, CG10 A

RA22 - Observing capability SC13, SC14, CG10 C

RA23 - Time organization capability SC13, SC14 K

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

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



5. Brief description of the subject and syllabus

5.1. Brief description of the subject

Outline

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

Learning Goals

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

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



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



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6. Schedule

6.1. Subject schedule*

Week	Face-to-face classroom activities	Face-to-face laboratory activities	Distant / On-line	Assessment activities
1	Section 1.1 and Section 1.2 Duration: 02:00 Lecture Individual work and group work. Duration: 01:00 Cooperative activities		Section 1.1 and Section 1.2 Duration: 02:00 Lecture Individual work and group work. Duration: 01:00 Cooperative activities	Participation in class discussions Topic selection Individual presentation Continuous assessment Presental Duration: 01:00
2	Section 2.1 Duration: 02:00 Lecture Individual work and group work. Duration: 01:00 Cooperative activities		Section 2.1 Duration: 02:00 Lecture Individual work and group work. Duration: 01:00 Cooperative activities	Participation in class discussions Topic selection Individual presentation Continuous assessment Presental Duration: 01:00
3	Section 2.2 Duration: 02:00 Lecture Individual work and group work. Duration: 01:00 Cooperative activities		Section 2.2 Duration: 02:00 Lecture Individual work and group work. Duration: 01:00 Cooperative activities	Participation in class discussions Topic selection Individual presentation Continuous assessment Presental Duration: 01:00
4	Section 3.1, Section 3.6 and Section 3.7 Duration: 01:00 Lecture Individual work and group work. Duration: 01:00 Cooperative activities		Section 3.1, Section 3.6 and Section 3.7 Duration: 01:00 Lecture Individual work and group work. Duration: 01:00 Cooperative activities	Participation in class discussions Topic selection Individual presentation Continuous assessment Presental Duration: 01:00
5	Section 3.2, Section 3.6 and Section 3.7. Duration: 01:00 Lecture Individual work and group work. Duration: 01:00 Cooperative activities		Section 3.2, Section 3.6 and Section 3.7. Duration: 01:00 Lecture Individual work and group work. Duration: 01:00 Cooperative activities	Participation in class discussions Topic selection Individual presentation Continuous assessment Presental Duration: 01:00
6	Section 3.3, Section 3.6 and Section 3.7. Duration: 01:00 Lecture Individual work and group work. Duration: 01:00 Cooperative activities		Section 3.3, Section 3.6 and Section 3.7. Duration: 01:00 Lecture Individual work and group work. Duration: 01:00 Cooperative activities	Participation in class discussions Topic selection Individual presentation Continuous assessment Presental Duration: 01:00



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



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15				Work and Presentation evaluation Individual work Continuous assessment Presential Duration: 02:00 Work about the topic of the course that the professor propose to the student previously. Individual work Final examination Presential Duration: 01:00 Feedback about other presentations provided by the professor. Individual presentation Final examination Presential Duration: 02:00 Oral presentations about some topics selected in advance by the professor. Individual presentation Final examination Presential Duration: 04:00
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.



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7. Activities and assessment criteria

7.1. Assessment activities

7.1.1. Continuous 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



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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	02:00	30%	0 / 10	CG3 CG18 CE13

7.1.2. Final examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
15	Work about the topic of the course that the professor propose to the student previously.	Individual work	Face-to-face	01:00	30%	0 / 10	CG3 CG18 CE13
15	Feedback about other presentations provided by the professor.	Individual presentation	Face-to-face	02:00	30%	5 / 10	CG3 CG18 CE13
15	Oral presentations about some topics selected in advance by the professor.	Individual presentation	Face-to-face	04:00	40%	5 / 10	CG3 CG18 CE13

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



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7.2. Assessment criteria

The attendance to the classes (presential or using video conference online at real time according to the sanitary authorities recommendations) to the classes is mandatory. A high number of absents classes will be enough for failing the course.

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 (presential or online) and
- the feedback to the classmates during the presentations of the rest of students.

8. Teaching resources

8.1. Teaching resources for the subject

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



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9. Other information

9.1. Other information about the subject

7.4.6 Correctness by Construction



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SUBJECT

103000657 - Correctness By Construction

DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

ACADEMIC YEAR & SEMESTER

2021/22 - Semester 2



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1. Description

1.1. Subject details

Name of the subject	103000657 - Correctness By Construction
No of credits	6 ECTS
Type	Optional
Academic year of the programme	First year
Semester of tuition	Semester 2
Tuition period	February-June
Tuition languages	English
Degree programme	10AM - Master Universitario en Ingeniería del Software
Centre	10 - Escuela Técnica Superior De Ingenieros Informáticos
Academic year	2021-22

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.



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

3. Prior knowledge recommended to take the subject

3.1. Recommended (passed) subjects

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

3.2. Other recommended learning outcomes

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

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

RA67 - RA-AV-2 - Acquaintance with various techniques for formal software development

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

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

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

RA70 - RA-AV-5 - Effective use of rigorous software development techniques.

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

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

5. Brief description of the subject and syllabus

5.1. Brief description of the subject

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

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

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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



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6. Schedule

6.1. Subject schedule*

Week	Face-to-face classroom activities	Face-to-face laboratory activities	Distant / On-line	Assessment activities
1	Introduction to formal methods and correctness by construction Duration: 01:30 Lecture Sample cases of formal development Duration: 01:30 Cooperative activities			
2	Event-B and related topics Duration: 02:00 Lecture Quizzes Duration: 01:00 Problem-solving class			
3	Event-B and related topics Duration: 01:00 Lecture			Homework: solutions and discussion Individual presentation Continuous assessment Presential Duration: 02:00
4	Event-B and related topics Duration: 02:00 Lecture Quizzes Duration: 01:00 Problem-solving class			
5	Event-B and related topics Duration: 02:00 Lecture Event-B and related topics Duration: 02:00 Lecture			
6	Event-B and related topics Duration: 01:00 Lecture			Homework: solutions and discussion Individual presentation Continuous assessment Presential Duration: 02:00
7	Event-B and related topics Duration: 02:00 Lecture Quizzes Duration: 01:00 Problem-solving class			



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8	Event-B and related topics Duration: 02:00 Lecture Quizzes Duration: 01:00 Problem-solving class			
9	Event-B and related topics Duration: 01:00 Lecture Event-B and related topics Duration: 02:00 Lecture			Homework: solutions and discussion Individual presentation Continuous assessment Presential Duration: 02:00
10	Quizzes Duration: 01:00 Problem-solving class Event-B and related topics Duration: 02:00 Lecture			
11	Event-B and related topics Duration: 02:00 Lecture Quizzes Duration: 01:00 Problem-solving class			
12	Quizzes Duration: 01:00 Problem-solving class Logic-based programming languages Duration: 02:00 Lecture			
13	Logic-based programming languages Duration: 02:00 Lecture			Homework: solutions and discussion Individual presentation Continuous assessment Presential Duration: 01:00
14	Quizzes Duration: 01:00 Problem-solving class Logic-based programming languages Duration: 02:00 Lecture			
15	Logic-based programming languages Duration: 02:00 Lecture			Homework: solutions and discussion Individual presentation Continuous assessment Presential Duration: 01:00
16				



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17				Presentation of a development made with one of the tools studied in the course Group presentation Continuous assessment Presental Duration: 03:00 Final regular exam Written test Final examination Presental 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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7. Activities and assessment criteria

7.1. Assessment activities

7.1.1. Continuous assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
3	Homework: solutions and discussion	Individual presentation	Face-to-face	02:00	14%	0 / 10	CE13 CG13 CE14
6	Homework: solutions and discussion	Individual presentation	Face-to-face	02:00	14%	0 / 10	CG13 CE14 CE13
9	Homework: solutions and discussion	Individual presentation	Face-to-face	02:00	14%	0 / 10	CG13 CE14 CE13
13	Homework: solutions and discussion	Individual presentation	Face-to-face	01:00	9%	0 / 10	CG13 CE14 CE13
15	Homework: solutions and discussion	Individual presentation	Face-to-face	01:00	9%	0 / 10	CG13 CE14 CE13
17	Presentation of a development made with one of the tools studied in the course	Group presentation	Face-to-face	03:00	40%	5 / 10	CE13 CG13 CE14

7.1.2. Final examination

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

7.1.3. Referred (re-sit) examination

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

Students will be evaluated based on their performance in the course homework / quizzes and the project. In the presentation, the quality of the information and the ability to answer questions on the decision designs will be taken into account. All students participating in a project are expected to also present part of the project and be able to answer questions to any part of the project.

8. Teaching resources

8.1. Teaching resources for the subject

Name	Type	Notes
Lawrence Paulson's class notes	Bibliography	Lawrence Paulson's Logic and Proof are the course notes of the author for a Logic course in Cambridge. Highly recommended, as they are both rigorous and very concise. They provide very good background material for both parts of the course.
Logic in Computer Science (Huth and Ryan)	Bibliography	A very good book on the use of logic in computer science is Logic in Computer Science, by Huth and Ryan. The Computer Science School should have several copies. There may be electronic copies on the Internet, if possible of the second edition.
http://wiki.event-b.org/	Web resource	Central Event-B site
Modeling in Event-B: System and Software Engineering, by Jean-Raymond Abrial.	Bibliography	The reference book for Event B, with plenty of worked examples.



http://ciao-lang.org/index.html	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: http://cliplab.org/papers/hermenegildo11:ciao-design-tlp.pdf

9. Other information

9.1. Other information about the subject

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

It is expected that the health situation for the Spring semester would have improved enough as to make it possible to use fully the classrooms. Therefore, face-to-face teaching has been planned.

If the health situation does not allow fully using the classrooms, teaching will change to a mixed online / face-to-face model.

7.4.7 Computer Security



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SUBJECT

103000738 - Computer Security

DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

ACADEMIC YEAR & SEMESTER

2021/22 - Semester 1

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1. Description

1.1. Subject details

Name of the subject	103000738 - Computer Security
No of credits	4 ECTS
Type	Optional
Academic year of the programme	First year
Semester of tuition	Semester 1
Tuition period	September-January
Tuition languages	English
Degree programme	10AM - Master Universitario en Ingeniería del Software
Centre	10 - Escuela Técnica Superior De Ingenieros Informáticos
Academic year	2021-22

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.



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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
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
Alessandra Gorla	alessandra.gorla@imdea.org	IMDEA Software Institute

3. Prior knowledge recommended to take the subject

3.1. Recommended (passed) subjects

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

3.2. Other recommended learning outcomes

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



4. Skills and learning outcomes *

4.1. Skills to be learned

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

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

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

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

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

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

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

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

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



4.2. Learning outcomes

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

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

5. Brief description of the subject and syllabus

5.1. Brief description of the subject

This course 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. Cryptography
2. Software Security
3. Information Access Control
4. Network security
5. Privacy



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6. Schedule

6.1. Subject schedule*

Week	Face-to-face classroom activities	Face-to-face laboratory activities	Distant / On-line	Assessment activities
1	Introduction to Computer Security Duration: 02:00 Lecture		Introduction to Computer Security Duration: 02:00 Lecture	
2	Cryptography Duration: 02:00 Lecture		Cryptography Duration: 02:00 Lecture	
3	Cryptography Duration: 02:00 Lecture		Cryptography Duration: 02:00 Lecture	
4	Cryptography Duration: 02:00 Lecture		Cryptography Duration: 02:00 Lecture	
5	Cryptography Duration: 02:00 Lecture		Cryptography Duration: 02:00 Lecture	Practical problem / exercise Individual work Continuous assessment Not Presential Duration: 02:00
6	Network security Duration: 02:00 Lecture		Network security Duration: 02:00 Lecture	
7	Network security Duration: 02:00 Lecture		Network security Duration: 02:00 Lecture	
8	Network security Duration: 02:00 Lecture		Network security Duration: 02:00 Lecture	Practical problem / exercise Individual work Continuous assessment Not Presential Duration: 02:00
9	Software security Duration: 02:00 Lecture		Software security Duration: 02:00 Lecture	
10	Software security Duration: 02:00 Lecture		Software security Duration: 02:00 Lecture	
11	Software security Duration: 02:00 Lecture		Software security Duration: 02:00 Lecture	Practical problem / exercise Individual work Continuous assessment Not Presential Duration: 02:00
12	Physical security Duration: 02:00 Lecture		Physical security Duration: 02:00 Lecture	



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13	Physical security Duration: 02:00 Lecture		Physical security Duration: 02:00 Lecture	
14	Physical security Duration: 02:00 Lecture		Physical security Duration: 02:00 Lecture	Practical problem / exercise Individual work Continuous assessment Not Presential Duration: 02:00
15	Seminar / TBD Duration: 02:00 Lecture		Seminar / TBD Duration: 02:00 Lecture	
16				
17				Final exam Written test Continuous assessment Presential Duration: 02:00 Comprehensive exam 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.



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7. Activities and assessment criteria

7.1. Assessment activities

7.1.1. Continuous assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
5	Practical problem / exercise	Individual work	No Presential	02:00	15%	0 / 10	CG9 CG7 E CG13 CG14 CE14 CG3 CG1 CG8 CE13
8	Practical problem / exercise	Individual work	No Presential	02:00	15%	0 / 10	CG9 CG7 E CG13 CG14 CE14 CG3 CG1 CG8 CE13
11	Practical problem / exercise	Individual work	No Presential	02:00	15%	0 / 10	CG9 CG7 E CG13 CG14 CE14 CG3 CG1 CG8 CE13
14	Practical problem / exercise	Individual work	No Presential	02:00	15%	0 / 10	CG9 CG7 E CG13 CG14 CE14 CG3 CG1 CG8 CE13



17	Final exam	Written test	Face-to-face	02:00	40%	0 / 10	CG9 CG7 E CG13 CG14 CE14 CG3 CG1 CG8 CE13
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7.1.2. Final examination

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

7.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Exam for the students who did not pass the course using continuous assesment.	Written test	Face-to-face	02:00	100%	5 / 10	CG9 CG7 E CG13 CG14 CE14 CG3 CG1 CG8 CE13



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7.2. Assessment criteria

8. Teaching resources

8.1. Teaching resources for the subject

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

9. Other information

9.1. Other information about the subject

The health situation caused by the COVID-19 may require restricting the occupation of the classroom and have a mixed model (face-to-face + online) for teaching. There may be turns for students inside each group, so that every week one of the turns may have to attend lectures in person while the rest of the turns will tune in remotely. Turns will rotate in attending the classroom.

If the health conditions are good enough, all students will attend lectures physically,.

If the health conditions worsen, lectures will shift to a remote-teaching mode. Face-to-face evaluation tests will be performed online.

7.4.8 Agent Based Software Development



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SUBJECT

103000538 - Agent-based Software Development

DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

ACADEMIC YEAR & SEMESTER

2021/22 - Semester 2

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1. Description

1.1. Subject details

Name of the subject	103000538 - Agent-Based Software Development
No of credits	6 ECTS
Type	Optional
Academic year of the programme	First year
Semester of tuition	Semester 2
Tuition period	February-June
Tuition languages	English
Degree programme	10AM - Master Universitario en Ingeniería del Software
Centre	10 - Escuela Técnica Superior De Ingenieros Informáticos
Academic year	2021-22

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Ricardo Imbert Paredes (Subject coordinator)	D-5112	ricardo.imbert@upm.es	Tu - 15:00 - 18:00 Th - 15:00 - 17:00 F - 15:00 - 16:00
Angelica De Antonio Jimenez	5108	angelica.deantonio@upm.es	W - 10:30 - 14:00 Th - 09:30 - 12:00 It is advisable to confirm by email the availability of the professor

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



member in charge.

3. Prior knowledge recommended to take the subject

3.1. Recommended (passed) subjects

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

3.2. Other recommended learning outcomes

- Programming (java)

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.

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

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



- 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



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6. Schedule

6.1. Subject schedule*

Week	Face-to-face classroom activities	Face-to-face laboratory activities	Distant / On-line	Assessment activities
1	1. Introduction to agents Duration: 02:00 Lecture 2 Agent oriented software engineering Duration: 00:15 Lecture			Exercise about risks on agent based software engineering Group work Continuous assessment and final examination Presential Duration: 00:45
2	2 Agent oriented software engineering Duration: 00:30 Lecture 3. Agent oriented analysis Duration: 01:00 Lecture 3. Agent oriented analysis Duration: 01:30 Problem-solving class			
3	8. Development process Duration: 00:30 Cooperative activities		Meeting in the classroom for the second practical assignment Duration: 00:30 Cooperative activities	Presentation in the classroom of the first practical assignment Individual presentation Continuous assessment and final examination Presential Duration: 02:00
4	4 Agent oriented architectural design Duration: 01:15 Lecture		Project coordination Duration: 03:00 Additional activities Project coordination Duration: 03:00 Additional activities	Exercise about systems topology Group work Continuous assessment and final examination Presential Duration: 00:45
5			Meeting in the classroom for the second practical assignment Duration: 01:00 Cooperative activities Project coordination Duration: 03:00 Additional activities	
6	5. Agent oriented detailed design (part I) Duration: 02:30 Lecture			Exercise about agent communication protocols Individual work Continuous assessment and final examination Presential Duration: 00:30



7	6. Agent implementation Duration: 01:00 Lecture 7. Agent oriented detailed design (part II) Duration: 01:00 Lecture 8. Development process Duration: 00:20 Lecture		Meeting in the classroom for the second practical assignment Duration: 00:40 Cooperative activities Project coordination Duration: 03:00 Additional activities	
8			Integration test meeting in the classroom Duration: 02:00 Cooperative activities Meeting in the classroom for the second practical assignment Duration: 01:00 Cooperative activities Project coordination Duration: 03:00 Additional activities	
9			Meeting in the classroom for the second practical assignment Duration: 01:00 Cooperative activities Project coordination Duration: 03:00 Additional activities	
10			Integration test meeting in the classroom Duration: 02:00 Cooperative activities Meeting in the classroom for the second practical assignment Duration: 01:00 Cooperative activities Project coordination Duration: 03:00 Additional activities	
11			Meeting in the classroom for the second practical assignment Duration: 01:00 Cooperative activities Project coordination Duration: 03:00 Additional activities	
12			Integration test meeting in the classroom Duration: 02:00 Cooperative activities Meeting in the classroom for the second practical assignment Duration: 01:00 Cooperative activities Project coordination Duration: 03:00	



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			Additional activities	
13			Meeting in the classroom for the second practical assignment Duration: 01:00 Cooperative activities Project coordination Duration: 03:00 Additional activities	
14			Integration test meeting in the classroom Duration: 02:00 Cooperative activities Meeting in the classroom for the second practical assignment Duration: 01:00 Cooperative activities Project coordination Duration: 03:00 Additional activities	
15			Integration test meeting in the classroom Duration: 02:00 Cooperative activities	
16				Presentation of the second practical assignment in the classroom Group presentation Continuous assessment and final examination Presential Duration: 02:00 Exercise about agent based development Group work Continuous assessment Presential Duration: 01:00
17				Exercise about comparison of agent based methodologies Individual work Final examination Presential Duration: 05:00 Student implication and participation Other assessment Continuous assessment Not Presential Duration: 00:00

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

* 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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7. Activities and assessment criteria

7.1. Assessment activities

7.1.1. Continuous 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	4%	0 / 10	CE14
3	Presentation in the classroom of the first practical assignment	Individual presentation	Face-to-face	02:00	15%	3 / 10	CE13 CE14
4	Exercise about systems topology	Group work	Face-to-face	00:45	4%	0 / 10	CE13
6	Exercise about agent communication protocols	Individual work	Face-to-face	00:30	3%	0 / 10	CE13
16	Presentation of the second practical assignment in the classroom	Group presentation	Face-to-face	02:00	60%	4 / 10	CE13 CE14
16	Exercise about agent based development	Group work	Face-to-face	01:00	4%	0 / 10	CE13
17	Student implication and participation	Other assessment	No Presential	00:00	10%	0 / 10	CE13

7.1.2. Final 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	4%	0 / 10	CE14
3	Presentation in the classroom of the first practical assignment	Individual presentation	Face-to-face	02:00	15%	3 / 10	CE13 CE14
4	Exercise about systems topology	Group work	Face-to-face	00:45	4%	0 / 10	CE13
6	Exercise about agent communication protocols	Individual work	Face-to-face	00:30	3%	0 / 10	CE13
16	Presentation of the second practical assignment in the classroom	Group presentation	Face-to-face	02:00	60%	4 / 10	CE13 CE14
17	Exercise about comparison of agent based methodologies	Individual work	Face-to-face	05:00	14%	0 / 10	CE13 CE14

7.1.3. Referred (re-sit) examination



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Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Exercise about risks on agent based software engineering	Individual work	Face-to-face	03:00	4%	0 / 10	CE14
First practical assignment	Individual work	Face-to-face	03:00	15%	3 / 10	CE13 CE14
Exercise about systems topology	Individual work	Face-to-face	03:00	4%	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	60%	4 / 10	CE13 CE14
Exercise about comparison of agent based methodologies	Individual work	Face-to-face	05:00	14%	0 / 10	CE13 CE14

7.2. Assessment criteria

The subject is marked following continuous assessment.

The student passes the subject only if 5 or more points on 10 are obtained at the end of the course, regarding the following criteria:

FINAL GRADE = 3% Individual exercises in the classroom + 12% Group exercises in the classroom + 15% First practical assignment + 60% Second practical assignment + 10% Student participation

The final grade will be obtained from five components: (1) individual exercises and (2) group exercises performed in the classroom; (3) a first practical assignment consisting in a brief document and a classroom presentation about applications of agents (proposed by the professor); (4) a second practical assignment about a group development of a multiagent system, with weekly classroom meetings and weekly software integration group activities, also in the classroom; and (5) participation and implication of the student in the subject.

The maximum grade for each of these components and the minimum mark 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 (and correspondence over the final grade)
Individual exercises in the classroom	10 (0,3)	-



(3%)		
Group exercises in the classroom (12%)	10 (1,2)	-
First practical assignment (15%)	10 (1,5)	3 (0,45)
Second practical assignment (60%)	10 (6)	4 (2,4)
Student participation (10%)	10 (1)	-

When failed, first and second practical assignment could be repeated in the extra exam period, using the new marks together to the ones obtained in individual and group exercises in the classroom and student participation in the previous period to calculate the final grade of the subject.

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



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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
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
http://moodle.upm.es/titulaciones/oficiales/course/view.php?id=1054	Web resource	Subject Moodle site
Room 6202	Equipment	Lecture and group work room

7.4.9 Experimental Software Engineering



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SUBJECT

103000542 - Experimental Software Engineering

DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

ACADEMIC YEAR & SEMESTER

2021/22 - Semester 2



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1. Description

1.1. Subject details

Name of the subject	103000542 - Experimental Software Engineering
No of credits	6 ECTS
Type	Optional
Academic year of the programme	First year
Semester of tuition	Semester 2
Tuition period	February-June
Tuition languages	English
Degree programme	10AM - Master Universitario en Ingeniería del Software
Centre	10 - Escuela Técnica Superior De Ingenieros Informáticos
Academic year	2021-22

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
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

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 *

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

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.



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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



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5.3. Parametric tests for related samples

5.4. Non parametric tests



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6. Schedule

6.1. Subject schedule*

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



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10		Brainstorming and group discussion of assignment 4 Duration: 04:00 Laboratory assignments		
11		Brainstorming and group discussion of assignment 4 Duration: 04:00 Laboratory assignments		
12				Presentation of assignment 4 Group presentation Continuous assessment Presentational Duration: 04:00
13				
14				
15				
16				
17				Final exam Written test Final examination Presentational Duration: 04:00

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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7. Activities and assessment criteria

7.1. Assessment activities

7.1.1. Continuous assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
9	Presentation of assignments 1-3	Group presentation	Face-to-face	04:00	50%	5 / 10	CG14 CG18 CE13 CE14 CG1 CG7 E CG13 CG6 CG8 CG9 CG3
12	Presentation of assignment 4	Group presentation	Face-to-face	04:00	50%	5 / 10	CG14 CG18 CE13 CG13 CE14 CG1 CG7 E CG6 CG8 CG9 CG3

7.1.2. Final examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
17	Final exam	Written test	Face-to-face	04:00	100%	5 / 10	CG13 CG14 CG18 CE13 CE14 CG1 CG7 E CG6 CG8 CG9 CG3

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

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Extraordinary exam	Written test	Face-to-face	04:00	100%	5 / 10	CG14 CG18 CE13 CG13 CE14 CG3 CG1 CG7 E CG6 CG8 CG9

7.2. Assessment criteria

- Students following continuous evaluation will be evaluated using the assignments only. No examination will be made. The assessment of assignments will depend on (1) presentation made by the students and (2) the correctness of the results. The final grade will be calculated using a weighted average as described above.
- Students following final test evaluation will be evaluated by means of an exam.



8. Teaching resources

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	www.moodle.upm.es
Laboratory	Equipment	TBD
Room	Equipment	MUIS room

7.4.10 Fundamentals of Business Administration



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SUBJECT

103000680 - Fundamentals Of Business Administration

DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

ACADEMIC YEAR & SEMESTER

2021/22 - Semester 2

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1. Description

1.1. Subject details

Name of the subject	103000680 - Fundamentals Of Business Administration
No of credits	4 ECTS
Type	Optional
Academic year of the programme	First year
Semester of tuition	Semester 2
Tuition period	February-June
Tuition languages	English
Degree programme	10AM - Master Universitario en Ingenieria del Software
Centre	10 - Escuela Tecnica Superior De Ingenieros Informaticos
Academic year	2021-22

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Pilar Quevedo Cano		pilar.quevedo@upm.es	W - 15:00 - 19:00 Th - 15:00 - 17:00
Ebru Susur Saurina Lucini (Subject coordinator)		ebru.susur@upm.es	Tu - 10:00 - 12:00

* 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
Marta Olea De Cárdenas	marta.olea@upm.es	ETSISI

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.

CG18 - Capacidad de trabajar y comunicarse también en contextos internacionales

3.2. Learning outcomes

RA77 - Understands basic business principles

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

4. Brief description of the subject and syllabus

4.1. Brief description of the subject

The course introduces the student to the contemporary global business world, entrepreneurship, marketing, managing people and organizations, resources and capabilities, managing information and financial issues.

The primary objective is to give the student an understanding of basic business principles.



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4.2. Syllabus

1. Global business environment
2. Entrepreneurship
3. Ideation
4. Marketing
5. Managing and organizing the business
6. Human resources management
7. Resources and capabilities
8. Market entry strategy
9. Accounting information and finance



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5. Schedule

5.1. Subject schedule*

Week	Face-to-face classroom activities	Face-to-face laboratory activities	Distant / On-line	Assessment activities
1	Course foundations Duration: 01:00 Additional activities		Course foundations Duration: 01:00 Additional activities	
2	Tema 1. Global business environment Duration: 02:00 Lecture		Tema 1. Global business environment Duration: 02:00 Lecture	
3	Tema 2. Entrepreneurship Duration: 02:00 Lecture		Tema 2. Entrepreneurship Duration: 02:00 Lecture	
4	Tema 3. Ideation Duration: 02:00 Lecture		Tema 3. Ideation Duration: 02:00 Lecture	
5	Tema 4. Marketing Duration: 02:00 Lecture		Tema 4. Marketing Duration: 02:00 Lecture	
6	Project workshop Duration: 02:00 Cooperative activities		Project workshop Duration: 02:00 Cooperative activities	
7	Tema 5. Managing and organizing the business Duration: 02:00 Lecture		Tema 5. Managing and organizing the business Duration: 02:00 Lecture	
8	Tema 6. Human resources management Duration: 02:00 Lecture		Tema 6. Human resources management Duration: 02:00 Lecture	
9	Project workshop Duration: 02:00 Cooperative activities		Project workshop Duration: 02:00 Cooperative activities	
10	Tema 8. Resources and capabilities Duration: 02:00 Lecture		Tema 8. Resources and capabilities Duration: 02:00 Lecture	
11	Tema 9. Market entry strategy Duration: 02:00 Lecture		Tema 9. Market entry strategy Duration: 02:00 Lecture	
12	Project workshop Duration: 02:00 Cooperative activities		Project workshop Duration: 02:00 Cooperative activities	
13	Tema 9. Accounting information and finance Duration: 02:00 Lecture		Tema 9. Accounting information and finance Duration: 02:00 Lecture	



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14	Project workshop Duration: 02:00 Cooperative activities		Project workshop Duration: 02:00 Cooperative activities	
15				Final report Group work Continuous assessment and final examination Not Presential Duration: 00:00 Final presentation Group work Continuous assessment and final examination Presential Duration: 02:00 Attendance and participation Other assessment Continuous assessment and final examination 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.



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6. Activities and assessment criteria

6.1. Assessment activities

6.1.1. Continuous assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
15	Final report	Group work	No Presential	00:00	60%	5 / 10	CE14 CG18
15	Final presentation	Group work	Face-to-face	02:00	30%	5 / 10	CE14 CE13 CG18
15	Attendance and participation	Other assessment	Face-to-face	00:00	10%	5 / 10	CG18

6.1.2. Final examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
15	Final report	Group work	No Presential	00:00	60%	5 / 10	CE14 CG18
15	Final presentation	Group work	Face-to-face	02:00	30%	5 / 10	CE14 CE13 CG18
15	Attendance and participation	Other assessment	Face-to-face	00:00	10%	5 / 10	CG18

6.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Test de conocimientos del curso	Written test	Face-to-face	01:00	100%	5 / 10	CE14 CE13



6.2. Assessment criteria

Students will complete a group project. This project is a written business plan about the creation of a new company. Students will develop their project through continuous work throughout the semester. Both lectures and workshops will provide them with the proper grounds for their projects

The written project report will be uploaded and printed. 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 defence) is compulsory. The presentation will be in groups, and the grade will be common for the whole group.

Active participation in both presental and online sessions will be considered to upgrade the mark to a maximum of 10%.

7. Teaching resources

7.1. Teaching resources for the subject

Name	Type	Notes
Ebert and Griffin (2016): Business Essentials. Prentice Hall	Bibliography	Main book
Samuelson and Nordhaus (2009): Economics. McGraw Hill.	Bibliography	The world business environment
Johnson et al. (2014): Exploring Strategy: Text and Cases. Pearson	Bibliography	The management process



8. Other information

8.1. Other information about the subject

In this seminar, 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



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SUBJECT

103000739 - Adaptive Systems

DEGREE PROGRAMME

10AM - Master Universitario En Ingenieria Del Software

ACADEMIC YEAR & SEMESTER

2021/22 - Semester 1



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1. Description

1.1. Subject details

Name of the subject	103000739 - Adaptive Systems
No of credits	4 ECTS
Type	Optional
Academic year of the programme	First year
Semester of tuition	Semester 1
Tuition period	September-January
Tuition languages	English
Degree programme	10AM - Master Universitario en Ingenieria del Software
Centre	10 - Escuela Tecnica Superior De Ingenieros Informaticos
Academic year	2021-22

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	W - 10:30 - 14:00 Th - 09:30 - 12:00
Jaime Ramirez Rodriguez (Subject coordinator)	5112	jaime.ramirez@upm.es	M - 16:00 - 18:00 Tu - 16:00 - 18:00 F - 10:00 - 12:00 by appointment by email

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



3. Prior knowledge recommended to take the subject

3.1. Recommended (passed) subjects

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

3.2. Other recommended learning outcomes

- Computer programming

4. Skills and learning outcomes *

4.1. Skills to be learned

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

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

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

CG18 - Capacidad de trabajar y comunicarse también en contextos internacionales

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



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

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

4.2. Learning outcomes

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

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

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

5. Brief description of the subject and syllabus

5.1. Brief description of the subject

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

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

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

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

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

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



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6. Schedule

6.1. Subject schedule*

Week	Face-to-face classroom activities	Face-to-face laboratory activities	Distant / On-line	Assessment activities
1	Presentation of the subject Duration: 02:00 Lecture		Presentation of the subject Duration: 02:00 Lecture	
2	User modeling for Adaptive Systems and Adaptive Web Duration: 02:00 Lecture		User modeling for Adaptive Systems and Adaptive Web Duration: 02:00 Lecture	
3	Recommender Systems Duration: 02:00 Lecture		Recommender Systems Duration: 02:00 Lecture	
4	Recommender Systems Duration: 02:00 Lecture		Recommender Systems Duration: 02:00 Lecture	
5	Recommender Systems Duration: 02:00 Lecture		Recommender Systems Duration: 02:00 Lecture	Exam Online test Continuous assessment and final examination Not Presential Duration: 01:00
6	Recommender Systems Duration: 02:00 Lecture		Recommender Systems Duration: 02:00 Lecture	Research work Individual work Continuous assessment and final examination Not Presential Duration: 07:00
7	Recommender Systems Duration: 02:00 Lecture		Recommender Systems Duration: 02:00 Lecture	Research work Individual work Continuous assessment and final examination Not Presential Duration: 07:00
8	Presentation of the research work Duration: 02:00 Additional activities		Presentation of the research work Duration: 02:00 Additional activities	Research work Individual work Continuous assessment and final examination Not Presential Duration: 10:00
9	Recommender Systems Duration: 02:00 Lecture		Recommender Systems Duration: 02:00 Lecture	Project work Group work Continuous assessment and final examination Not Presential Duration: 20:00



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10	Dialog Systems Duration: 02:00 Lecture		Dialog Systems Duration: 02:00 Lecture	Project work Group work Continuous assessment and final examination Not Presential Duration: 20:00
11	Project supervision Duration: 02:00 Additional activities		Project supervision Duration: 02:00 Additional activities	Project work Group work Continuous assessment and final examination Not Presential Duration: 10:00
12	Technology-enhanced adaptive learning Duration: 02:00 Lecture		Technology-enhanced adaptive learning Duration: 02:00 Lecture	
13	Technology-enhanced adaptive learning Duration: 02:00 Lecture		Technology-enhanced adaptive learning Duration: 02:00 Lecture	
14	Technology-enhanced adaptive learning Duration: 02:00 Lecture		Technology-enhanced adaptive learning Duration: 02:00 Lecture	
15	Research topic presentations Duration: 02:00 Additional activities		Research topic presentations Duration: 02:00 Additional activities	Research topic analysis Individual presentation Continuous assessment and final examination Presential Duration: 08:00
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.



7. Activities and assessment criteria

7.1. Assessment activities

7.1.1. Continuous assessment

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



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15	Research topic analysis	Individual presentation	Face-to-face	08:00	25%	5 / 10	CG13 CG3 CE13 CE14
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7.1.2. Final examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
5	Exam	Online test	No Presential	01:00	10%	0 / 10	CE13 CE14 CG13
6	Research work	Individual work	No Presential	07:00	5%	5 / 10	CE13 CE14 CG13 CG3
7	Research work	Individual work	No Presential	07:00	5%	5 / 10	CE13 CE14 CG13 CG3
8	Research work	Individual work	No Presential	10:00	5%	5 / 10	CE13 CE14 CG13 CG3
9	Project work	Group work	No Presential	20:00	20%	5 / 10	CE13 CE14 CG18 CG13 CG8 CG9
10	Project work	Group work	No Presential	20:00	20%	5 / 10	CG8 CG18 CE13 CE14 CG13 CG9
11	Project work	Group work	No Presential	10:00	10%	5 / 10	CE13 CE14 CG8 CG18 CG13 CG9
15	Research topic analysis	Individual presentation	Face-to-face	08:00	25%	5 / 10	CG13 CG3 CE13 CE14

7.1.3. Referred (re-sit) examination



Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Research work	Individual work	Face-to-face	20:00	75%	5 / 10	CE13 CE14 CG18 CG13 CG3 CG8 CG9
Exam Technology-enhanced learning	Written test	Face-to-face	02:00	25%	5 / 10	CE13 CE14 CG13

7.2. Assessment criteria

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.



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Article 2	Bibliography	O'Donnell, E., Lawless, S., Sharp, M., Wade, V. (2015) A Review of Personalised E-Learning: Towards Supporting Learner Diversity. International Journal of Distance Education Technologies, 13(1), 22-47, January-March 2015
book 3	Bibliography	K. Falk. Practical Recommender Systems. 2019. Publisher: Manning Publications

9. Other information

9.1. Other information about the subject

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

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