

**1. General information****Course:** AUTOMATA THEORY AND COMPUTATION**Code:** 42342**Type:** ELECTIVE**ECTS credits:** 6**Degree:** 406 - UNDERGRADUATE DEGREE IN COMPUTER SCIENCE AND ENGINEERING (AB)**Academic year:** 2023-24**Center:** 604 - SCHOOL OF COMPUTER SCIENCE AND ENGINEERING (AB)**Group(s):** 15**Year:** 3**Duration:** C2**Main language:** Spanish**Second language:** English**Use of additional languages:****English Friendly:** Y**Web site:****Bilingual:** N**Lecturer:** FERNANDO LOPEZ PELAYO - Group(s): 15

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**2. Pre-Requisites**

As this subject is taught in the third year of the degree it is expected that all the necessary requirements are met. Therefore, it is expected that there will be a basic background in:

- Mathematical formalisms: Set theory in Algebra. Basic mathematical background on proof techniques, especially Induction.

- Languages and Programming Techniques: Mainly Imperative Style. It is expected that the student would be non-dependant on a specific programming language for final implementation (if required). The students are expected to know some programming languages in order to better illustrate the usefulness of using grammars.

More specifically, the student should:

- Be able to work within a mathematical and formal framework.

- have abstraction capacity that allows them to identify the key ideas and concepts above the details and / or notation used.

**3. Justification in the curriculum, relation to other subjects and to the profession**

Automata theory and Computation is basic background for on both Science and Technique of Computing, in fact it has always been included in the Curriculum of these studies from its origins. At present, for the sake of a technification of the discipline, the study of this subject has remained part of the Computation itinerary, due to its more scientific nature.

In this subject, where both is justified and established the basis of the studies, there can be found most of the basic concepts studied and used in almost all other subjects. What is a programming language, how and why is it defined in the way it is done? What is the mechanism in which it is translated into a formalism understandable by a machine, why is that specifically, and what are the limitations that can be found, among many others.

This subject is strongly linked with others, as are all having mathematical nature, since formerly the subject has this origin, as well as those with a certain theoretical component related to programming, such as Language Processors, Declarative Programming, and all those in which the Artificial Intelligence has a certain weight.

**4. Degree competences achieved in this course****Course competences**

Code	Description
CM01	Ability to acquire thorough knowledge about fundamental principles and models in computation, and to apply them for the interpretation, selection, assessment, modelling, and creation of new concepts, theories, uses, and development of those technologies in the field of IT.
CM02	Ability to know the theoretical fundamentals of programming languages, and their associated techniques for lexical, syntactic, and semantic processes, along with their application in the creation, design, and language processing.
INS01	Analysis, synthesis, and assessment skills.
INS04	Problem solving skills by the application of engineering techniques.
INS05	Argumentative skills to logically justify and explain decisions and opinions.
SIS01	Critical thinking.
SIS03	Autonomous learning.
UCLM03	Accurate speaking and writing skills.

**5. Objectives or Learning Outcomes****Course learning outcomes**

Description

Understanding of the theoretical foundations of computability and decidability.

Understanding and skills in the definition of regular and context-free languages  $\mathcal{L}$  as well as the computers that recognize them.

#### Additional outcomes

Knowing the formal languages theory concepts that can be applied to Informatics, e.g., formal language definition, skills and tools for formal language processing, goals for this processing, etc...

Connecting these previous concepts with some others that are widely used throughout the studies of the degree, among which should be included those related to programming languages.

### 6. Units / Contents

**Unit 1: Introduction**

**Unit 2: Formal Languages**

**Unit 3: Formal Grammars**

**Unit 4: Finite Automata / Finite State Machine**

**Unit 5: Regular expressions**

**Unit 6: Regular Languages properties**

**Unit 7: Context Free Grammars**

**Unit 8: PushDown Automata**

**Unit 9: Turing Machines**

### 7. Activities, Units/Modules and Methodology

Training Activity	Methodology	Related Competences (only degrees before RD 822/2021)	ECTS	Hours	As	Com	Description
Class Attendance (theory) [ON-SITE]	Combination of methods	CM01 CM02 INS01	0.64	16	N	-	
Problem solving and/or case studies [ON-SITE]	Problem solving and exercises	CM01 CM02 INS01 INS05 SIS01 UCLM03	0.64	16	N	-	
Problem solving and/or case studies [ON-SITE]	Problem solving and exercises	CM01 CM02 INS01 SIS01 SIS03 UCLM03	0.96	24	N	-	
Progress test [ON-SITE]	Assessment tests	CM01 CM02 INS01 SIS01 UCLM03	0.24	6	Y	N	
Project or Topic Presentations [ON-SITE]	Group Work	INS01 SIS01 UCLM03	0.64	16	Y	N	
Study and Exam Preparation [OFF-SITE]	Self-study	CM01 CM02 INS01 SIS01	2.4	60	N	-	
In-class Debates and forums [ON-SITE]	Debates	INS01 SIS01 UCLM03	0.24	6	N	-	
Final test [ON-SITE]	Assessment tests	CM01 CM02 INS01 SIS01 UCLM03	0.24	6	Y	N	
<b>Total:</b>			<b>6</b>	<b>150</b>			
<b>Total credits of in-class work: 3.6</b>			<b>Total class time hours: 90</b>				
<b>Total credits of out of class work: 2.4</b>			<b>Total hours of out of class work: 60</b>				

As: Assessable training activity

Com: Training activity of compulsory overcoming (It will be essential to overcome both continuous and non-continuous assessment).

### 8. Evaluation criteria and Grading System

Evaluation System	Continuous assessment	Non-continuous evaluation*	Description
Test	80.00%	80.00%	Partial Test and if required Final Test
Self Evaluation and Co-evaluation	10.00%	10.00%	LAB work
Oral presentations assessment	10.00%	10.00%	
<b>Total:</b>	<b>100.00%</b>	<b>100.00%</b>	

According to art. 4 of the UCLM Student Evaluation Regulations, it must be provided to students who cannot regularly attend face-to-face training activities the passing of the subject, having the right (art. 12.2) to be globally graded, in 2 annual calls per subject, an ordinary and an extraordinary one (evaluating 100% of the competences).

#### Evaluation criteria for the final exam:

##### Continuous assessment:

Written test: 60%.

Practical work: 20%.

The delivery of the internship work will be mandatory: 10%.

Oral presentations of topics, including work and memory of practices: 10%

##### Non-continuous evaluation:

Evaluation criteria not defined

#### Specifications for the resit/retake exam:

Written test to assess theoretical and practical knowledge.

The delivery of the internship is compulsory.

#### Specifications for the second resit / retake exam:

Written test to assess theoretical and practical knowledge.

The delivery of the internship is compulsory.

9. Assignments, course calendar and important dates	
Not related to the syllabus/contents	
<b>Hours</b>	<b>hours</b>
In-class Debates and forums [PRESENCIAL][Debates]	4
Final test [PRESENCIAL][Assessment tests]	6
Unit 1 (de 9): Introduction	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Combination of methods]	1
Study and Exam Preparation [AUTÓNOMA][Self-study]	2
In-class Debates and forums [PRESENCIAL][Debates]	1
Unit 2 (de 9): Formal Languages	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Combination of methods]	1
Study and Exam Preparation [AUTÓNOMA][Self-study]	2
In-class Debates and forums [PRESENCIAL][Debates]	1
Unit 3 (de 9): Formal Grammars	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Combination of methods]	1
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	2
Progress test [PRESENCIAL][Assessment tests]	1
Study and Exam Preparation [AUTÓNOMA][Self-study]	2
Unit 4 (de 9): Finite Automata / Finite State Machine	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Combination of methods]	3
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	2
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	4
Progress test [PRESENCIAL][Assessment tests]	1
Project or Topic Presentations [PRESENCIAL][Group Work]	3
Study and Exam Preparation [AUTÓNOMA][Self-study]	10
Unit 5 (de 9): Regular expressions	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Combination of methods]	3
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	2
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	4
Progress test [PRESENCIAL][Assessment tests]	1
Project or Topic Presentations [PRESENCIAL][Group Work]	3
Study and Exam Preparation [AUTÓNOMA][Self-study]	10
Unit 6 (de 9): Regular Languages properties	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Combination of methods]	2
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	3
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	4
Progress test [PRESENCIAL][Assessment tests]	1
Project or Topic Presentations [PRESENCIAL][Group Work]	3
Study and Exam Preparation [AUTÓNOMA][Self-study]	10
Unit 7 (de 9): Context Free Grammars	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Combination of methods]	2
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	3
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	4
Progress test [PRESENCIAL][Assessment tests]	1
Project or Topic Presentations [PRESENCIAL][Group Work]	3
Study and Exam Preparation [AUTÓNOMA][Self-study]	10
Unit 8 (de 9): PushDown Automata	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Combination of methods]	2
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	2
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	4
Progress test [PRESENCIAL][Assessment tests]	1
Project or Topic Presentations [PRESENCIAL][Group Work]	4
Study and Exam Preparation [AUTÓNOMA][Self-study]	10
Unit 9 (de 9): Turing Machines	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Combination of methods]	1
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	2
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	4
Study and Exam Preparation [AUTÓNOMA][Self-study]	4
Global activity	
<b>Activities</b>	<b>hours</b>
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	24
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	16

Progress test [PRESENCIAL][Assessment tests]	6
Project or Topic Presentations [PRESENCIAL][Group Work]	16
Study and Exam Preparation [AUTÓNOMA][Self-study]	60
Class Attendance (theory) [PRESENCIAL][Combination of methods]	16
In-class Debates and forums [PRESENCIAL][Debates]	6
Final test [PRESENCIAL][Assessment tests]	6
<b>Total horas: 150</b>	

10. Bibliography and Sources						
Author(s)	Title/Link	Publishing house	City	ISBN	Year	Description
Isasi P., Martínez P., Borrajo D	Lenguajes, Gramáticas y Autómatas. Un enfoque práctico <a href="http://www.casadellibro.com/libro-lenguajes-gramaticas-y-automatas-un-enfoque-practico/9788478290147/792972">http://www.casadellibro.com/libro-lenguajes-gramaticas-y-automatas-un-enfoque-practico/9788478290147/792972</a>	Addison Wesley		9788478290147	1997	Ejemplos interesantes
Hopcroft, J.E.; Motwani R.; Ullman, J.D.:	Introducción a la teoría de Autómatas, Lenguajes y Computación. <a href="http://www.casadellibro.com/libro-introduccion-a-la-teoria-de-automataslenguajes-y-computacion/9789682612220/484262">http://www.casadellibro.com/libro-introduccion-a-la-teoria-de-automataslenguajes-y-computacion/9789682612220/484262</a>	Prentice-Hall			2002	Libro básico de referencia
J Glenn Brookshear	Teoría de la Computación: Lenguajes Formales, Autómatas y Complejidad <a href="https://www.casadellibro.com/libro-teoria-de-la-computacion-lenguajes-formales-automatas-y-complejidad/9789684443846/730597">https://www.casadellibro.com/libro-teoria-de-la-computacion-lenguajes-formales-automatas-y-complejidad/9789684443846/730597</a>	Alhambra Mexicana		9789684443846	2000	Muy ameno y didáctico
F. Sande González	Prácticas de teoría de autómatas y lenguajes formales <a href="http://www.gobiernodecanarias.org/educacion/dgoie/publicace/scripts/detalle.asp?p=477">http://www.gobiernodecanarias.org/educacion/dgoie/publicace/scripts/detalle.asp?p=477</a>	Gobierno de Canarias	Tenerife		2001	Texto para prácticas de la asignatura