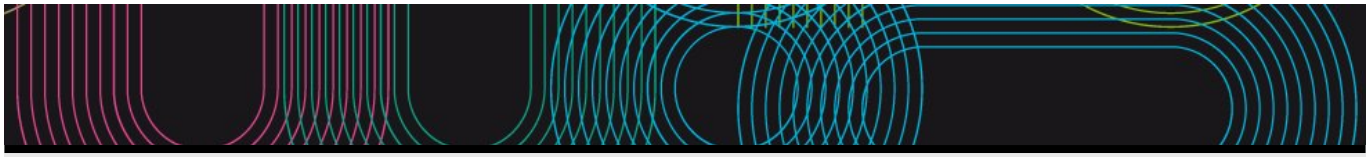

IDENTIFYING DATA				
Intelligent systems				
Subject	Intelligent systems			
Code	O06G151V01309			
Study programme	Grado en Ingeniería Informática			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3rd	2nd
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	González Moreno, Juan Carlos			
Lecturers	González Moreno, Juan Carlos Rodríguez Martínez, Francisco Javier			
E-mail	jcmoreno@uvigo.es			
Web	http://moovi.uvigo.gal			
General description	This subject is taught in the second semester of the third year. It tries to provide the student with the minimum necessary knowledge about fundamental concepts that allow the resolution of problems in the field of intelligent systems, and an adequate understanding of how to approach the resolution of said problems. This subject includes basic competences for the future professional practice of the Technical Engineer / Technical Engineer in Computer Science, if this is developed in the field of Artificial Intelligence, and also instrumental skills for the acquisition of other skills. In teaching the content, both the Spanish and Galician languages will be used interchangeably. In what respect to English language, it will be used both in audiovisual and written materials used in the subject; and also it will be used as auxiliary language for those Erasmus students who can enroll in the subject and have difficulties to understand both Spanish and Galician languages. Inglés: English Friendly subject: International students may request from the teachers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

Training and Learning Results	
Code	
A2	Students will be able to apply their knowledge and skills in their professional practice or vocation and they will show they have the required expertise through the construction and discussion of arguments and the resolution of problems within the relevant area of study.
A4	Students will be able to present information, ideas, problems and solutions both to specialist and non-specialist audiences.
B3	Ability to design, develop, assess and ensure accessibility, ergonomics, usability and safety of computing systems, services and applications, as well as the information managed by them.
B6	Ability to conceive and develop centralized or distributed computing systems and architectures, integrating hardware, software and networks, according to the knowledge and training acquired.
B8	Knowledge of the essential subjects and technologies that will allow students to learn and develop new methods and technologies, as well as those that will endow them with versatility to adapt to new situations.
B9	Ability to solve problems by taking the initiative, making decisions and acting independently and creatively. Ability to communicate the knowledge contents, skills and abilities of the Computer Science Engineer profession.
C3	Ability to understand and master the essential concepts of discrete mathematics, mathematical logic, algorithmic mathematics and computational complexity, and their application to the resolution of engineering problems.
C7	Ability to design, develop, choose and assess computer applications and systems to guarantee their reliability, safety and quality, according to ethical principles and existing legislation and regulations.
C12	Knowledge and application of basic algorithmic procedures of computer technologies to design solutions to problems, analyzing the appropriacy and complexity of the proposed algorithms.
C13	Knowledge, design and efficient use of the most appropriate data structures and types for the resolution of a problem.

C14	Ability to analyze, design, build and maintain applications in a robust, safe and efficient way, choosing the most appropriate paradigm and programming languages.
C21	Knowledge and application of the fundamental principles and basic techniques of intelligent systems and their practical application.
C26	Ability to assess clients needs and determine the software requirements to satisfy these needs, reconciling conflicting goals through attempts to reach acceptable compromises within the limits imposed by costs, available times, existing developed systems and organizations themselves.
C28	Ability to identify and analyze problems and design, develop, implement, verify and document software solutions on the basis of sound knowledge of the theories, models and techniques available nowadays.
D4	Analysis, synthesis and evaluation capacity
D6	Ability to abstract: ability to create and use models that reflect real situations
D7	Ability to search, relate and structure information from various sources and to integrate ideas and knowledge.
D8	Ability to work in situations of lack of information and / or under pressure
D9	Ability to quickly integrate and work efficiently in unidisciplinary teams and to collaborate in a multidisciplinary environment
D10	Interpersonal relationship skills.
D11	Critical thinking
D14	Have motivation for quality and continuous improvement

Expected results from this subject

Expected results from this subject	Training and Learning Results			
RA1.- To know and understand the main characteristics of the problems to which to give a solution based on Artificial Intelligence techniques	A2 A4	B6 B8 B9	C12 C14 C21 C26 C28	D4 D6 D7 D10 D11
RA2.- To satisfactorily carry out the activities of problem solving in Artificial Intelligence.	A4	B3 B6 B8 B9	C7 C12 C14 C21	D7 D8 D9 D10 D11
RA3.- To specify and model a problem, using knowledge representation methods	A4	B6 B8 B9	C7 C14 C21 C26 C28	D4 D6 D14
RA4.- To know the logical and structured formalisms necessary for the representation of knowledge	A2	B8	C3 C13 C21 C28	D6 D7 D14
RA5.- To know and know how to use declarative languages for the resolution of Artificial Intelligence problems	A2 A4	B6 B8 B9	C14 C21 C26 C28	D4 D7 D8 D14
RA6.- To know the problems and solutions associated with the planning of robots and software agents.	A2 A4	B6 B8 B9	C14 C21 C26 C28	D7 D8 D9 D11
RA7.- To understand the problems associated with machine learning and the most appropriate solution techniques.	A2 A4	B6 B8 B9	C14 C21 C28	D4 D6 D7 D10 D11 D14

Contents

Topic	
Resolution of problems	Introduction to the Intelligent Systems The Artificial Intelligence (IA) The IA into the Intelligent Systems Bots and virtual assistants
Planning for robots /agents	Intelligent agents Logical Agents Theoretical Planning Planning in the real world

Systems based in the knowledge	Systems based in rules Systems structured
Representation of the Knowledge	Logical Representation of the Uncertainty
Models of reasoning and learning	Types of Learning Probabilistic Reasoning Theory of the decision
Searches and heuristics	Basic searches Optimal searches Heuristic searches

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	9	9	18
Flipped Learning	10.5	21	31.5
Presentation	1.5	6	7.5
Laboratory practical	22	44	66
Objective questions exam	0	2	2
Report of practices, practicum and external practices	3	6	9
Essay	1	3	4
Problem and/or exercise solving	0	12	12

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

Methodologies

	Description
Lecturing	Exposure by the teacher of the basic and introductory contents of the subject. The virtual campus will be used (as far as possible) to provide the content to those students who cannot attend the master classes in person. CONTINUOUS ASSESSMENT Mandatory character Attendance: Not Mandatory GLOBAL ASSESSMENT Mandatory character
Flipped Learning	During a good part of the course, certain topics and questions will be proposed, with audiovisual and supporting reading material, so that the student reflects and seeks solutions that allow them to acquire and practice transversal competences such as: their capacity for analysis, synthesis and evaluation; her critical reasoning ability; their ability to search, relate and structure information from various sources and to integrate ideas and knowledge; or their ability to work in situations of lack of information and / or under pressure. To carry out this methodology, both the virtual Campus and the remote Campus will be used. CONTINUOUS ASSESSMENT Mandatory character Attendance: Not Mandatory GLOBAL ASSESSMENT Mandatory character
Presentation	Exposure by students of certain subject contents through the creation and display of short videos. These videos will be developed in small groups of between 2 and 4 people; The videos will be accompanied by a memory of no more than 3500 words that will be delivered together with the video and a series of test questions. The memory will be evaluated as a group work, and the tests will be used to assess the degree of knowledge acquisition of all students. To carry out this methodology, both the virtual Campus and the remote Campus will be used. CONTINUOUS ASSESSMENT Mandatory character Attendance: Not Mandatory GLOBAL ASSESSMENT Mandatory character

Laboratory practical	Activities to apply knowledge to specific situations and to acquire basic and procedural skills related to the subject matter under study. They are developed in special spaces with specialized equipment (laboratories, computer rooms, etc.). CONTINUOUS ASSESSMENT Mandatory character Attendance: Not Mandatory GLOBAL ASSESSMENT Mandatory character

Personalized assistance

Methodologies	Description
Lecturing	The teacher will advise the student in solving the problems they find in understanding the content seen and worked on throughout the course. The teacher will use as support, for that, both the remote Campus and the virtual campus as the circumstances require. The tutorials may be carried out by telematic means (email, videoconference, FAITIC forums, ...) under the modality of prior agreement.
Presentation	The teacher will advise the student on the way in which to organize the content chosen for exposure to the rest of the student body. The teacher will use as support, for this, both the remote Campus and the virtual campus as the circumstances require. The tutorials may be carried out by telematic means (email, videoconference, FAITIC forums, ...) under the modality of prior agreement.
Tests	**Description**
Report of practices, practicum and external practices	The teacher will advise the student on the way in which they must organize and present the internship report, using the Remote Campus or the Virtual Campus as the circumstances require. The tutorials may be carried out using telematic means (email, videoconference, FAITIC forums, ...) under the modality of prior agreement.
Objective questions exam	The teacher will advise the student on the ideal way to take the exam; for which both the Remote Campus and the Virtual Campus will be helped as circumstances require. The tutorials may be carried out using telematic means (email, videoconference, FAITIC forums, ...) under the modality of prior agreement.
Essay	The teacher will advise the student on the problems they encounter in understanding the content, and in the most appropriate way to organize it; for which both the Remote Campus and the Virtual Campus will be helped as circumstances require. The tutorials may be carried out using telematic means (email, videoconference, FAITIC forums, ...) under the modality of prior agreement.

Assessment

	Description	Qualification	Training and Learning Results
Presentation	The Presentation test is aimed at working fundamentally on the expected results of the subject: RA4, RA6 and RA7. This methodological test is mandatory, both in continuous and global assessment. and will consist of the delivery, on the date indicated, of a video of no more than 10' in length on a theory topic to be chosen from a list proposed by the teacher. To release this part of the evaluation, the student must get 5 points or more in their grade. Late deliveries and those that are delivered in a different format than the order will be rated 0.	10	A2 B8 C3 D4 A4 B9 C21 D7 C28 D8 D9 D10 D11 D14

Laboratory practical	The Laboratory Practices Test is aimed at working fundamentally on the expected results of the subject: RA1, RA2, RA3, RA4, RA5, RA6 and RA7 This test will be evaluated with the applications provided to be carried out in groups of 2-4 people. This test consists of two deliveries in the modality of continuous evaluation and one if the global evaluation is chosen. Said deliveries must be made on the dates and in the manner indicated. The weight of the second installment, in the continuous evaluation, will be 70% in the final average of the test. The deliveries require a defense by the members of the group on the date and in the manner indicated. To release this assessment test, the student must get 5 points or more in their final grade Late deliveries and those that are delivered in a different format than the order will be rated 0.	35	A2 B3 C3 D8 B6 C7 D9 B8 C13 D10 C14 D11 C21 D14 C26 C28
Objective questions exam	The exam test of objective questions allows to evaluate the theoretical knowledge associated with the following expected results of the subject: RA1, RA2, RA3, RA4, RA5, RA6 and RA7 This test allows the evaluation of the contents presented through the Lección Magistral and Presentation methodologies. This methodological test is mandatory and global. To release this part of the evaluation, the student must get 5 points or more in their grade.	20	A2 B8 C3 D4 B9 C12 D6 C13 D11 C21 D14 C28
Report of practices, practicum and external practices	This test will be carried out in groups of between 2-4 people and complements the learning results of the Laboratory Practices. The Practice Report Test complements the laboratory practice test by working on the following subject results: RA1, RA2, RA3, RA4, RA5, RA6 and RA7 This test consists of two deliveries in the modality of continuous evaluation and one if the global evaluation is chosen. Said deliveries must be made on the dates and in the manner indicated. The weight of the second installment, in the continuous evaluation, will be 70% in the final average of the test. The deliveries require a defense by the members of the group on the date and in the manner indicated. To release this assessment test, the student must get 5 points or more in their final grade. Late deliveries and those that are delivered in a different format than the order will be rated 0.	15	A2 B3 C7 D4 A4 B6 C12 D6 B9 C13 D7 C14 D11 C21 D14 C26 C28
Essay	The Work test is oriented to complement the following results of the subject: RA4, RA6 and RA7 This methodological test is compulsory, both in continuous and global evaluation, and will consist of the delivery, on the date and in the manner indicated, of a report on a theory topic to be chosen from a list proposed by the professor. To release this part of the evaluation, the student must get 5 points or more in their grade. Late deliveries and those that are delivered in a different format than the order will be rated 0.	10	A2 B8 C3 D4 A4 B9 C21 D7 C28 D8 D9 D10 D11 D14

Problem and/or exercise solving	This test is designed to work on the contents developed in the Flipped Learning and Laboratory Practices methodology by delivering individual exercises in which the student will apply said contents. The problem-solving test and/or exercises allow you to complete the evaluation of the results of the subject: RA1, RA2, RA3, RA4, RA5, and RA6 The character of this test and voluntary. The exercises will be counted as they are delivered in the continuous assessment. In the case of opting for the global evaluation, on the date of the exam the students will be able to answer the exercises that are presented.	10	A2 B3 C3 D4 A4 B8 C12 D6 B9 C13 D7 C21 D8 C28 D11 D14

Other comments on the Evaluation

CONTINUOUS ASSESSMENT SYSTEM

TEST 1: Elaboration of Memory and Video

Description: *Preparation of a video and a brief memory that presents/defends the student's solution to the assigned work. The work will be developed in pairs and delivered offline on the date to be determined. This test is mandatory*

Methodology(s) applied(s): Presentation + Work

Qualifying: 20%

Minimum: *For the release of this part of the subject, the student must obtain a score equal to or greater than 5 points (out of 10) in the evaluation of both the memory (10%) and the video (10%). Late deliveries and those that do not meet the parameters set for delivery will be scored 0 points.*

TEST 2: Project

Description: *After the fourth week, a "Project" will be proposed to be developed and solved in groups of 2-4 people. The solution will evolve over the weeks with the support of laboratory classes in which doubts will be resolved and the feasibility of the proposed solution will be continuously verified. The Project will consist of 2 increments that will consist of a documented code (35%) along with a report explaining and justifying the proposed solution (15%), the reports will be delivered on the dates and in the manner indicated. The first installment will have a weight of 40%, while the second will have a weight of 60%. This test is mandatory*

Applied Methodology(s): Laboratory Practices + Practice Report

Qualifying: 50% (20%+30%)

Minimum: For the release of this part of the course, students must obtain a grade equal to or greater than 5 points (out of 10) in the evaluation of both the report and the code delivered. Once the delivery has been made, a defense of the work carried out will be required in order to verify its authorship, if this defense is not sufficiently passed, the qualification of the test will be 4 points.

TEST 3: Objective Questions Exam

Description: *Completion of a final test consisting of a series of short multiple choice questions to assess the knowledge acquired in the master classes and Flipped Learning. This test is mandatory.*

Applied Methodology(s): Lecture, Presentation and Flipped Learning.

Qualifying: 20%

Minimum: *For the release of this part of the subject, the student must obtain a grade equal to or greater than 5 points (out of 10) in the final grade of the test.*

TEST 4: Resolution of problems and/or exercises

Description: *Throughout the semester, each week the offline delivery (on the platform indicated) of solutions to a series of theory and practice exercises will be voluntarily proposed. In the theoretical part, the exercises are designed to direct the study and autonomous work of the students in the Flipped Learning classes, while in practice they are designed to facilitate the division of labor and the practice of code necessary for the solution of the assigned Project. This test is voluntary.*

Applied Methodology(s): Flipped Learning Laboratory Practice

Qualifying: 10%

Minimum: *The voluntary nature of this test means that a minimum is not required for its passing. The grade is obtained cumulatively based on deliveries made throughout the course.*

 The final grade for the subject is calculated using the weighted average of the previous tests. In order to take said average, the student must achieve at least a 4 in each of the mandatory tests described above.

 If, at the end of the course, a student presents a grade of less than 4 in more than one of the previous compulsory tests, her grade will be determined by the minimum value between the average of the marks of said tests and four.

 All the deliveries of the previous tests that are not carried out on time, or in the requested form will be qualified with a 0.

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GLOBAL EVALUATION SYSTEM

Procedure for choosing the global assessment modality: Since the default assessment system is CONTINUOUS ASSESSMENT, it is considered that all enrolled students opt for said system. In case of wanting to be evaluated through the GLOBAL EVALUATION system, "Once the period of one month from the beginning of the semester has passed, a period of 5 working days will be enabled for the students enrolled in the subject to formally state their intention to benefit from the GLOBAL EVALUATION system).

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TEST 1: Elaboration of Memory and Video

Description: *Elaboration of a video and a brief memory that presents/defends the student's solution to a theory work that is assigned to them, the work will be delivered offline on the date to be determined (before the official exam date in each call). This test is mandatory and may require a defense of the work by answering a series of written questions on the day of the exam.*

Methodology(s) applied(s): Presentation + Work

Qualifying: 20%

Minimum: *For the release of this part of the subject, the student must obtain a score equal to or greater than 5 points (out of 10) in the evaluation of both the memory (10%) and the video (10%). Late deliveries and those that do not meet the parameters set for delivery will be scored 0 points.*

TEST 2: Project

Description: *The delivery of a solution to a specific project (different from the continuous assessment system) will be proposed for the students who take advantage of this assessment system. The delivery will consist of the documented code of the project (35%) together with a report that justifies and conveniently describes the proposed solution (15%). The delivery will be made on the date (always prior to the exam date) and in the manner indicated. This test is mandatory and will require your defense by answering a series of written questions on the day of the exam.*

Applied Methodology(s): Laboratory Practices + Practice Report

Qualifying: 40%

Minimum: *For the release of this part of the course, students must obtain a grade equal to or greater than 5 points (out of 10) in the evaluation of both the report and the code delivered. Once the delivery has been made, a defense of the work carried out will be required in order to verify its authorship.*

TEST 3: Objective Questions Exam

Description: *Completion of a final test consisting of a series of short multiple choice questions to assess the knowledge acquired in the master classes and Flipped Learning. This test is mandatory.*

Applied Methodology(s): Lecture, Presentation and Flipped Learning.

Qualifying: 40%

Minimum: *For the release of this part of the subject, the student must obtain a grade equal to or greater than 5 points (out of 10) in the final grade of the test.*

- The final grade for the subject is calculated using the weighted average of the previous tests. In order to take said average, the student must achieve at least a 4 in each of the tests.
- Tests 1 and 2 can only obtain a grade of 4 points, when the defense questions were not answered or will not be answered adequately.
- If, at the end of the course, a student presents a grade of less than 4, in one or more of the previous tests, her grade will be determined by the minimum value between the average of the grades of said tests and four.
- All deliveries of the previous tests that are not carried out on time or in the requested manner will be graded with a 0.

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EVALUATION CRITERIA FOR EXTRAORDINARY CALL AND FINAL DEGREE

The continuous and global evaluation systems described above will be used.

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RECORD QUALIFICATION PROCESS

Regardless of the evaluation system and the call, if all the mandatory tests described above are not passed with more than a four, the mark that will appear in the minutes will be 4.

EVALUATION DATES

The dates of the tests corresponding to the continuous assessment system will be published in the calendar of activities, available on the ESEI website https://esei.uvigo.es/docencia/horarios/.

The official exam dates of the different calls, officially approved by the Xunta de Centro of the ESEI, are published on the ESEI website https://esei.uvigo.es/docencia/horarios/.

USE OF MOBILE DEVICES

All students are reminded of the prohibition of the use of mobile devices in exercises and practices, in compliance with article 13.2.d) of the University Student Statute, regarding the duties of university students, which establishes the duty to "Refrain from using or cooperation in fraudulent procedures in the evaluation tests, in the works that are carried out or in official documents of the university."

---**CONSULTATION/REQUEST FOR TUTORIALS**

The tutorials can be consulted through the personal page of the teaching staff, accessible through https://esei.uvigo.es/docencia/profesorado/

Sources of information

Basic Bibliography

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Stuart Jonathan Russell, Peter Norvig, **Artificial Intelligence: A Modern Approach**, ISBN-13: 9780136042594, 3ª, Prentice Hall, 2010

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Stuart Russell, Peter Norving., **Inteligencia Artificial. Un enfoque moderno**, ISBN 10: 842054003X ISBN 13: 9788420540030, 2ª, Pearson Educación, 2004

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Complementary Bibliography

Hopgood, Adrian A., **Intelligent Systems for Engineers and Scientists**, https://doi.org/10.1201/b11287, Tercera, CRC Press, 2012

Plamen Angelov, Dimitar P. Filev, Nikola K. Kasabov, **Evolving Intelligent Systems: Methodology and Applications**, ISBN: 9780470569962 | DOI: 10.1002/9780470569962, Wiley, 2010

Robert J. Schalkoff, **Intelligent Systems: Priciples, paradigms and pragmatics**, ISBN-10: 0763780170 ISBN-13: 2900763780172, Jones and Bartlett Publishers, 2010

Nils. J. Nilsson, **Inteligencia Artificial: Una nueva síntesis**, ISBN 8448128249, 9788448128241, McGraw Hill., 2001

F. Escolano Ruiz et. al., **Inteligencia Artificial. Modelos, técnicas y áreas de aplicación**, ISBN: 978-84-9732-183-9, Thomson, 2003

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Recommendations

Subjects that are recommended to be taken simultaneously

Concurrency and distribution/O06G151V01308

Subjects that it is recommended to have taken before

Mathematics: Mathematical analysis/O06G151V01102
Programming 2/O06G151V01109
Algorithms and data structures 2/O06G151V01202
Software engineering 1/O06G151V01204
Software engineering 2/O06G151V01208
Mathematics: Statistics/O06G151V01201
Computing logic/O06G151V01301

Other comments

It is recommended that students keep a continuous pace of learning and that they work according to the forecast indicated in this guide, to the indications given by the professor of the subject based on the teaching methodology used. In any case, it is recommended that at least the same hours that have been used in the classroom be spent outside the classroom. In this way it will be possible to achieve continuous and adequate learning to be able to successfully pass the subject.

If the student observes that the hours spent outside the classroom during the first 4 weeks of class are higher than those indicated in this guide, it is advisable to arrange a tutorial with the subject coordinator teacher, to be advised on how to approach in a more effective study of content.

It is also strongly recommended to carry out a comprehensive reading of the documentation recommended by the teacher, prior to the theory classes, even in the case of using the master class methodology. Indicate that this recommendation becomes mandatory in those contents that are going to be treated following the flipped-learning methodology, since if it is not done, the student will not be able to follow up and have an adequate understanding of the associated contents.