



POLITÉCNICA

INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

COORDINATION PROCESS OF  
LEARNING ACTIVITIES  
PR/CL/001



E.T.S. de Ingenieros  
Informáticos

# ANX-PR/CL/001-01

## LEARNING GUIDE

### SUBJECT

**103000904 - Intelligent Systems**

### DEGREE PROGRAMME

10BA - Master Universitario En Ciencia De Datos

### ACADEMIC YEAR & SEMESTER

2021/22 - Semester 1

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## 1. Description

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### 1.1. Subject details

<b>Name of the subject</b>	103000904 - Intelligent Systems
<b>No of credits</b>	4.5 ECTS
<b>Type</b>	Optional
<b>Academic year of the programme</b>	First year
<b>Semester of tuition</b>	Semester 1
<b>Tuition period</b>	September-January
<b>Tuition languages</b>	English
<b>Degree programme</b>	10BA - Master Universitario en Ciencia de Datos
<b>Centre</b>	10 - Escuela Tecnica Superior De Ingenieros Informaticos
<b>Academic year</b>	2021-22

## 2. Faculty

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### 2.1. Faculty members with subject teaching role

<b>Name and surname</b>	<b>Office/Room</b>	<b>Email</b>	<b>Tutoring hours *</b>
Martin Molina Gonzalez (Subject coordinator)	2111	martin.molina@upm.es	Sin horario.
Asuncion De Maria Gomez Perez	2209	asunciondemaria.gomez@upm.es	Sin horario.
M. Carmen Suarez De Figueroa Baonza	2201	mdelcarmen.suarezdefigueroa@upm.es	Sin horario.

Daniel Manrique Gamo	2109	daniel.manrique@upm.es	Sin horario.
Mariano Rico Almodovar		mariano.rico@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. Skills and learning outcomes \*

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#### 3.1. Skills to be learned

CG11 - Conocimiento y comprensión de la informática para crear modelos, así como sistemas y procesos de información complejos

CG14 - Capacidad de trabajar y comunicarse también en contextos internacionales

#### 3.2. Learning outcomes

RA44 - Apply artificial intelligence techniques for building intelligent systems

RA43 - Identify application areas of intelligent systems

RA41 - Apply knowledge acquisition methods to create knowledge bases using other sources of information (e.g., datasets or text documents)

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

## 4. Brief description of the subject and syllabus

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### 4.1. Brief description of the subject

In a broad sense, intelligent systems can be considered as a type of computer system that integrates artificial intelligence algorithms to solve problems in complex environments using limited resources. Intelligent systems are capable of acquiring and using knowledge by integrating methods based on machine learning, knowledge representation and reasoning.

This course presents AI techniques that are applicable to the design and construction of intelligent systems. The course starts with a general characterization of intelligent systems and an overview of the main approaches and basic concepts. Then, the course presents methods of artificial intelligence that can be used to develop different cognitive abilities of intelligent systems. These methods are presented following a formal theoretical approach together with practical exercises.

In particular, the course explains: (1) the foundations of neural networks, which have been used with great success, for example, in problems related to perception or classification, (2) how an intelligent system can learn to act using reinforcement learning techniques, (3) ontologies that are useful, for example, for symbolic knowledge representation and knowledge integration, and (4) natural language processing methods that are useful to facilitate the communication between systems and humans.

## 4.2. Syllabus

1. Intelligent systems
  - 1.1. General characterization of intelligent systems
  - 1.2. Knowledge representation and reasoning
2. Neural networks
  - 2.1. Representing neural networks
  - 2.2. Training neural networks
3. Reinforcement learning
  - 3.1. Sequential decision problems
  - 3.2. Reinforcement learning algorithms
4. Ontology engineering
  - 4.1. Ontologies and ontology design patterns
  - 4.2. How to develop ontologies
5. Natural language processing
  - 5.1. Morphology
  - 5.2. Syntax and semantics

## 5. Schedule

### 5.1. Subject schedule\*

Week	Face-to-face classroom activities	Face-to-face laboratory activities	Distant / On-line	Assessment activities
1	<b>Course introduction</b> Duration: 02:00		<b>Course introduction</b> Duration: 02:00	
2	<b>Lecture on Unit 1</b> Duration: 02:00		<b>Lecture on Unit 1</b> Duration: 02:00	
3	<b>Lecture on Unit 1</b> Duration: 02:00		<b>Lecture on Unit 1</b> Duration: 02:00	
4	<b>Lecture on Unit 2</b> Duration: 02:00		<b>Lecture on Unit 2</b> Duration: 02:00	
5	<b>Lecture on Unit 2</b> Duration: 02:00		<b>Lecture on Unit 2</b> Duration: 02:00	
6	<b>Lecture on Unit 2</b> Duration: 02:00		<b>Lecture on Unit 2</b> Duration: 02:00	
7	<b>Lecture on Unit 3</b> Duration: 02:00		<b>Lecture on Unit 3</b> Duration: 02:00	
8	<b>Lecture on Unit 3</b> Duration: 02:00		<b>Lecture on Unit 3</b> Duration: 02:00	
9	<b>Lecture on Unit 3</b> Duration: 02:00		<b>Lecture on Unit 3</b> Duration: 02:00	
10	<b>Lecture on Unit 4</b> Duration: 02:00		<b>Lecture on Unit 4</b> Duration: 02:00	<b>Assessment of Units 1-2-3</b> Continuous assessment Not Presential Duration: 02:00
11	<b>Lecture on Unit 4</b> Duration: 02:00		<b>Lecture on Unit 4</b> Duration: 02:00	
12	<b>Lecture on Unit 4</b> Duration: 02:00  <b>Group tutoring session</b> Duration: 02:00		<b>Lecture on Unit 4</b> Duration: 02:00  <b>Group tutoring session</b> Duration: 02:00	

13	<b>Lecture on Unit 5</b> Duration: 02:00  <b>Group tutoring session</b> Duration: 02:00		<b>Lecture on Unit 5</b> Duration: 02:00  <b>Group tutoring session</b> Duration: 02:00	
14	<b>Lecture on Unit 5</b> Duration: 02:00  <b>Group tutoring session</b> Duration: 02:00		<b>Lecture on Unit 5</b> Duration: 02:00  <b>Group tutoring session</b> Duration: 02:00	
15	<b>Lecture on Unit 5</b> Duration: 02:00  <b>Group tutoring session</b> Duration: 02:00		<b>Lecture on Unit 5</b> Duration: 02:00  <b>Group tutoring session</b> Duration: 02:00	
16				<b>Assessment of Unit 4</b>  Continuous assessment Not Presential Duration: 00:00  <b>Assessment of Unit 5</b>  Continuous assessment Not Presential Duration: 00:00
17				<b>Assessment of Units 1-2-3</b>  Final examination Presential Duration: 02:00  <b>Assessment of Unit 4</b>  Final examination Not Presential Duration: 00:00  <b>Assessment of Unit 5</b>  Final examination 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.



## 6. Activities and assessment criteria

### 6.1. Assessment activities

#### 6.1.1. Continuous assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
10	Assessment of Units 1-2-3		No Presential	02:00	50%	2 / 10	CG14 CG11
16	Assessment of Unit 4		No Presential	00:00	25%	2 / 10	CG14 CG11
16	Assessment of Unit 5		No Presential	00:00	25%	2 / 10	CG14 CG11

#### 6.1.2. Final examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
17	Assessment of Units 1-2-3		Face-to-face	02:00	50%	2 / 10	CG14 CG11
17	Assessment of Unit 4		No Presential	00:00	25%	2 / 10	CG14 CG11
17	Assessment of Unit 5		No Presential	00:00	25%	2 / 10	CG14 CG11

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

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Assessment of Units 1-2-3		Face-to-face	02:00	50%	2 / 10	CG14 CG11
Assessment of Unit 4		Face-to-face	00:00	25%	2 / 10	CG14 CG11
Assessment of Unit 5		Face-to-face	00:00	25%	2 / 10	CG14 CG11

## 6.2. Assessment criteria

Partial and final grades are on the scale of 0 to 10. To pass the course it is required that the final grade G must be  $G \geq 5$ .

"Continuous" assessment and "final examination" are mutually exclusive. Students who want to follow "final examination" must inform the coordinator (martin.molina@upm.es) at the beginning of the course (in the first two weeks of the course). Otherwise, continuous assessment is followed.

Students who follow "final examination" or "referred (re-sit) examination" must submit to the coordinator (martin.molina@upm.es) the practical projects at least one week before the day established for the written examination. The student will be allowed to take the written examination if the student has submitted in advance the practical projects.

## 7. Teaching resources

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### 7.1. Teaching resources for the subject

Name	Type	Notes
UPM Moodle	Web resource	Support to on-line education
Bibliography	Bibliography	Selected bibliography (papers and text books)

## 8. Other information

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### 8.1. Other information about the subject

The health situation caused by the COVID-19 pandemic forces to restrict the capacity of the classrooms and therefore it has been decided that the teaching of this semester will be of mixed attendance. Shifts will be established within the groups, so that each week one shift will attend class in the classroom (column "face-to-face classroom activity" of the schedule), while the rest of the shifts will connect to the class remotely (column "distant / on-line"). And each week a different shift will come to the classroom.

If health conditions improve and face-to-face classes can be held normally, all students will go to the classrooms to receive the classes indicated in the "face-to-face classroom activity" column. On the other hand, if health conditions worsen, all students will be connected to the remote classes in the "distant / on-line" column.

This course is related to the "Sustainable Development Goal 9" (Build resilient infrastructure, promote sustainable industrialization and foster innovation), defined by the United Nations Development Programme ([www.undp.org](http://www.undp.org)) in terms of innovation and scientific research in information technologies.