



## Teaching Guide

| Identifying Data         |   |        |                      |           | 2022/23 |
|--------------------------|---|--------|----------------------|-----------|---------|
| Subject (*)              | Real Time Intelligent Systems                   |        | Code                 | 614544026 |         |
| Study programme          | Máster Universitario en Intelixencia Artificial |        |                      |           |         |
| Descriptors              |   |        |                      |           |         |
| Cycle                    | Period  | Year   | Type                 | Credits   |         |
| Official Master's Degree | 2nd four-month period                           | First  | Optional             | 3         |         |
| Language                 | English   |        |                      |           |         |
| Teaching method          | Face-to-face                                    |        |                      |           |         |
| Prerequisites            |   |        |                      |           |         |
| Department               |   |        |                      |           |         |
| Coordinador              | Cabalar Fernandez, Jose Pedro                   | E-mail | pedro.cabalar@udc.es |           |         |
| Lecturers                | Cabalar Fernandez, Jose Pedro                   | E-mail | pedro.cabalar@udc.es |           |         |
| Web                      |   |        |                      |           |         |
| General description      |   |        |                      |           |         |

## Study programme competences / results

| Code | Study programme competences / results  |
|------|--|
| A8   | CE07 - Ability to understand the consequences of the development of an explainable and interpretable intelligent system  |
| A9   | CE08 - Ability to design and develop secure intelligent systems, in terms of integrity, confidentiality and robustness   |
| A10  | CE09 - Ability to obtain a deep knowledge about fundamental principles and models of quantum computing and to apply them for the interpretation, selection, evaluation, modelling and creation of new concepts, theories, uses and technological developments related to Artificial Intelligence |
| A14  | CE13 - Knowledge of computer tools in the field of data analysis and statistical modelling and ability to select those ones most suitable for problem solving  |
| A15  | CE14 - Understanding and command of the main machine learning techniques, including those devised for big volumes of data. Understanding and command of basic concepts and techniques for information search and filtering in big collections of data.   |
| A16  | CE15 - Knowledge of computer tools in the field of machine learning and ability to select those ones most suitable for problem solving   |
| A20  | CE19 - Knowledge of the different environments where AI based technologies can be applied and awareness of their capability to provide a differentiating added value   |
| A21  | CE20 - Ability to combine and adapt different techniques, extrapolating knowledge among different application domains  |
| A22  | CE21 - Knowledge of the techniques that facilitate the efficient organisation and management of AI projects in real environments, including resources management and tasks scheduling and taking into account the concepts of knowledge dissemination and open science                           |
| A23  | CE22 - Knowledge of the techniques that facilitate the security of data, applications and communications and the derived consequences on different application domains in AI   |
| A28  | CE27 - Understanding the significance of the entrepreneurial culture and knowledge of the resources within the entrepreneur person's means   |
| A29  | CE28 - Appropriate knowledge of the concept of enterprise, its organisation and management, and of the different business sectors, with the goal of providing solutions from the AI perspective  |
| A30  | CE29 - Being able to apply knowledge, abilities and attitudes to the business and professional world, by planning, managing and evaluating projects in the scope of AI   |
| A31  | CE30 - Being able to set out, model and solve problems that require the application of AI methods, techniques and technologies   |
| B1   | CG01 - Maintaining and extending theoretical foundations to allow the introduction and exploitation of new and advanced technologies in the field of AI  |
| B2   | CG02 - Successfully addressing each and every stage of an AI project   |
| B5   | CG05 - Working in teams, especially of multidisciplinary nature, and being skilled in the management of time, people and decision making   |
| B6   | CB01 - Acquiring and understanding knowledge that provides a basis or opportunity to be original in the development and/or application of ideas, frequently in a research context  |
| B7   | CB02 - The students will be able to apply the acquired knowledge and to use their capacity of solving problems in new or poorly explored environments inside wider (or multidisciplinary) contexts related to their field of study   |



|     |   |
|-----|---|
| B9  | CB04 - The students will be able to communicate their conclusions, their premises and their ultimate justifications, both to specialised and non-specialised audiences, using a clear style language, free from ambiguities |
| B10 | CB05 - The students will acquire learning abilities to allow them to continue studying in way that will mostly be self-directed or autonomous   |
| C2  | CT02 - Command in understanding and expression, both in oral and written forms, of a foreign language   |
| C4  | CT04 - Acquiring a personal development for practicing a citizenship under observation of the democratic culture, the human rights and the gender perspective   |
| C5  | CT05 - Understanding the importance of the entrepreneurial culture and knowledge of the resources within the entrepreneur person's means  |
| C6  | CT06 - Acquiring abilities for life and healthy customs, routines and life styles   |

| Learning outcomes  |                                       |      |     |
|--|---------------------------------------|------|-----|
| Learning outcomes  | Study programme competences / results |      |     |
| Knowing the features and functions of a real-time system   | AC7                                   | BC1  | CC2 |
|  | AC8                                   | BC2  | CC4 |
|  | AC9                                   | BC5  | CC5 |
|  | AC13                                  | BC6  | CC6 |
|  | AC14                                  | BC9  |     |
|  | AC15                                  | BC10 |     |
|  | AC19                                  |      |     |
|  | AC20                                  |      |     |
|  | AC21                                  |      |     |
|  | AC22                                  |      |     |
| Ability to design and program a real-time system   | AC7                                   | BC7  | CC2 |
|  | AC8                                   | BC9  | CC4 |
|  | AC9                                   | BC10 | CC5 |
|  | AC13                                  |      | CC6 |
|  | AC14                                  |      |     |
|  | AC15                                  |      |     |
|  | AC19                                  |      |     |
|  | AC22                                  |      |     |
|  | AC27                                  |      |     |
| Knowing the most common programming languages for real-time systems, both synchronous and asynchronous | AC7                                   | BC1  | CC2 |
|  | AC8                                   | BC2  | CC4 |
|  | AC9                                   | BC5  | CC5 |
|  | AC13                                  | BC6  | CC6 |
|  | AC14                                  | BC7  |     |
|  | AC15                                  | BC9  |     |
|  | AC19                                  | BC10 |     |
|  | AC20                                  |      |     |
|  | AC21                                  |      |     |
|  | AC22                                  |      |     |
|  | AC27                                  |      |     |
|  | AC28                                  |      |     |
|  | AC29                                  |      |     |
|  | AC30                                  |      |     |



|  |      |      |     |
|--|------|------|-----|
| Knowing how to develop trustable software components, with special emphasis on fail tolerance and error recovery | AC7  | BC1  | CC2 |
|  | AC8  | BC2  | CC4 |
|  | AC9  | BC5  | CC5 |
|  | AC13 | BC6  | CC6 |
|  | AC14 | BC7  |     |
|  | AC15 | BC9  |     |
|  | AC19 | BC10 |     |
|  | AC20 |      |     |
|  | AC21 |      |     |
|  | AC22 |      |     |
|  | AC27 |      |     |
|  | AC28 |      |     |
|  | AC29 |      |     |
|  | AC30 |      |     |

| Contents                                |   |
|---|---|
| Topic                                   | Sub-topic                               |
| Real Time Systems                       | Real Time Systems                       |
| Determinism and trustability            | Determinism and trustability            |
| Paralelism                              | Paralelism                              |
| Synchronous and asynchronous hypotheses | Synchronous and asynchronous hypotheses |
| Implementation languages                | Implementation languages                |
| Simulation                              | Simulation                              |
| Behaviour verification                  | Behaviour verification                  |
| Planning strategies                     | Planning strategies                     |
| Architectures                           | Architectures                           |

| Planning                       |   |                                      |                               |             |
|--------------------------------|---|--------------------------------------|-------------------------------|-------------|
| Methodologies / tests          | Competencies / Results  | Teaching hours (in-person & virtual) | Student's personal work hours | Total hours |
| Laboratory practice            | A8 A9 A10 A14 A15<br>A16 A20 A21 A22<br>A23 A28 A29 A31<br>A30 B1 B2 B5 B6 B7<br>B9 B10 C2 C4 C5 C6 | 10.5                                 | 21                            | 31.5        |
| Objective test                 | A8 A9 A10 A14 A15<br>A16 A20 A21 A22<br>A23 A28 A29 A31<br>A30 B1 B2 B5 B6 B7<br>B9 B10 C2 C4 C5 C6 | 1.5                                  | 10.5                          | 12          |
| Guest lecture / keynote speech | A8 A9 A10 A14 A15<br>A16 A20 A21 A22<br>A23 A28 A29 A31<br>A30 B1 B2 B5 B6 B7<br>B9 B10 C2 C4 C5 C6 | 10.5                                 | 21                            | 31.5        |
| Personalized attention         |   | 0                                    |                               | 0           |

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

| Methodologies |             |
|---------------|-------------|
| Methodologies | Description |
|               |             |



|                                |   |
|--------------------------------|---|
| Laboratory practice            | Practical work, normally in groups, with tools of real time systems |
| Objective test                 | Individual exam   |
| Guest lecture / keynote speech | Classes of concepts and foundations with small exercises            |

| Personalized attention  |   |
|---|---|
| Methodologies   | Description   |
| Guest lecture / keynote speech<br>Laboratory practice<br>Objective test | Tutorials and remote guidance by e-mail or online platform (Teams, moodle, etc) |

| Assessment                     |   |   |               |
|--------------------------------|---|---|---------------|
| Methodologies                  | Competencies / Results  | Description   | Qualification |
| Guest lecture / keynote speech | A8 A9 A10 A14 A15<br>A16 A20 A21 A22<br>A23 A28 A29 A31<br>A30 B1 B2 B5 B6 B7<br>B9 B10 C2 C4 C5 C6 | Depending on how the course evolves, a part of the exam could be consolidated by submitting solved exercises along the lecture classes period | 0.5           |
| Laboratory practice            | A8 A9 A10 A14 A15<br>A16 A20 A21 A22<br>A23 A28 A29 A31<br>A30 B1 B2 B5 B6 B7<br>B9 B10 C2 C4 C5 C6 | Submission of one or several practical assignments  | 49.5          |
| Objective test                 | A8 A9 A10 A14 A15<br>A16 A20 A21 A22<br>A23 A28 A29 A31<br>A30 B1 B2 B5 B6 B7<br>B9 B10 C2 C4 C5 C6 | An individual exam consisting of several exercises that will be assessed up to a maximum of 50 points   | 50            |

| Assessment comments |
|---------------------|
|                     |

| Sources of information |  |
|------------------------|--|
| Basic                  |  |
| Complementary          |  |

| Recommendations  |  |
|--|--|
| Subjects that it is recommended to have taken before     |  |
| Machine Learning I /614544012                            |  |
| Deep Learning /614544013                                 |  |
| Machine Learning II /614544014                           |  |
| Knowledge and Reasoning under Uncertainty/614544007      |  |
| Reasoning and Planning /614544003                        |  |
| Subjects that are recommended to be taken simultaneously |  |
|  |  |
| Subjects that continue the syllabus                      |  |
|  |  |
| Other comments   |  |



(\*)The teaching guide is the document in which the URV publishes the information about all its courses. It is a public document and cannot be modified. Only in exceptional cases can it be revised by the competent agent or duly revised so that it is in line with current legislation.