Teaching Guide				
Identifying Data				2023/24
Subject (*)	Rule-Based Quantum Systems		Code	614551029
Study programme	Máster Universitario en Ciencia e Tecnoloxías de Información Cuántica			
Descriptors				
Cycle	Period	Year	Type	Credits
Official Master's Degree	2nd four-month period	First	Optional	3
Language	SpanishGalician			
Teaching method	Face-to-face			
Prerequisites				
Department	Ciencias da Computación e Tecnoloxías da Información			
Coordinador	Moret Bonillo, Vicente	E-mail	vicente.moret@udc.es	
Lecturers	Moret Bonillo, Vicente	E-mail	vicente.moret@udc.es	
Web	n9.cl/yx2z48			
General description	Este curso trata de establecer sinerxías entre dúas áreas de investigación e desenvolvemento aparentemente inconexas: a intelixencia artificial e a computación cuántica. O curso comeza cunha breve descrición das orixes da intelixencia artificial simbólica e do tipo de problemas que se pretende resolver. A continuación, céntrase nun tipo específico de programas simbólicos de intelixencia artificial, os sistemas baseados en regras. Os aspectos relacionados cos sistemas baseados en regras trataranse de forma exhaustiva e rigorosa desde a perspectiva da computación cuántica. Esta materia inclúe o desenvolvemento de modelos cuánticos para o tratamento do coñecemento inexacto, e a construción dunha arquitectura cuántica equivalente a un circuíto inferencial convencional. O asunto conclúe coa construción dun sistema baseado en regras cuánticas.			

Study programme competences	
Code	Study programme competences
A3	CON_03 Know the physical bases that allow information to be coded and processed. Understanding of the new rules that Quantum Mechanics imposes for its processing.
A4	CON_04 Have knowledge of quantum computing, algorithms, circuits, their programming in different languages and accessible platforms.
B1	HD01 Analyze and break down a complex concept, examine each part and see how they fit together
B3	HD03 Compare and contrast and point out similarities and differences between two or more topics or concepts
B6	HD11 Prepare accurately the relevant questions for a specific problem.
B8	HD13 Improvise solutions in an innovative way to solve a problem.
B12	HD23 Communicate using the expected norms for the chosen medium.
B13	HD24 Actively participate in face-to-face activities in the classroom.
B14	HD31 Assign resources and responsibilities so that all members of a team can work optimally
B16	HD33 Set goals for the group to analyze the situation, decide what outcome is desired and clearly set an achievable goal.
C1	C1. Adequate oral and written expression in the official languages.
C2	C2. Mastering oral and written expression in a foreign language.
C3	C3. Using ICT in working contexts and lifelong learning.
C4	C4. Acting as a respectful citizen according to democratic cultures and human rights and with a gender perspective.
C7	C7. Developing the ability to work in interdisciplinary or transdisciplinary teams in order to offer proposals that can contribute to a sustainable environmental, economic, political and social development.
C8	C8. Valuing the importance of research, innovation and technological development for the socioeconomic and cultural progress of society.

Learning outcomes	
Learning outcomes	Study programme competences

Aprender a establecer sinergias entre la inteligencia artificial simbólica y la computación cuántica.	AJ3 AJ4	BJ1 BJ3 BJ6 BJ8 BJ12 BJ13 BJ14 BJ16	CJ1 CJ2 CJ3 CJ4 CJ7 CJ8
Adquirir conocimientos de computación cuántica, algoritmia y circuitos cuánticos.	AJ3 AJ4	BJ1 BJ3 BJ6 BJ8 BJ12 BJ13 BJ14 BJ16	CJ1 CJ2 CJ3 CJ4 CJ7 CJ8
Programación en diferentes lenguajes y plataformas accesibles.	AJ3 AJ4	BJ1 BJ3 BJ6 BJ8 BJ12 BJ13 BJ14 BJ16	CJ1 CJ2 CJ3 CJ4 CJ7 CJ8
Adquirir conocimientos sobre aspectos de alto nivel en computación cuántica: diseño de máquinas cuánticas, simuladores cuánticos y arquitecturas.	AJ3 AJ4	BJ1 BJ3 BJ6 BJ8 BJ12 BJ13 BJ14 BJ16	CJ1 CJ2 CJ3 CJ4 CJ7 CJ8

Contents	
Topic	**Sub-topic**
Introducción	Antecedentes Inteligencia artificial simbólica
Sistemas de Producción	Conocimiento declarativo Conocimiento procedimental Motor de inferencias
Circuitos Inferenciales Cuánticos	Representación cuántica del conocimiento Propagación cuántica del conocimiento Diseño de circuitos cuánticos categóricos
Representación Cuántica del Conocimiento Inexacto	Conocimiento inexacto Conocimiento impreciso Incertidumbre y propagación
Modelo Cuántico de Factores de Certeza	Medidas de confianza Factores de certeza Aproximación cuántica del modelo S-B Implementación cuántica del modelo S-B

Consideraciones Finales	Análisis crítico Conclusiones

Planning				
Methodologies / tests	Competencies	Ordinary class hours	Student?s personal work hours	Total hours
Guest lecture / keynote speech	A3 A4 B1 B3 B6 B8 B12 B13 B14 B16 C1 C2 C3 C4 C7 C8	10	50	60
ICT practicals	A3 A4 B1 B3 B6 B8 B12 B13 B14 B16 C1 C2 C3 C4 C7 C8	15	0	15
Personalized attention		0	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
Guest lecture / keynote speech	Explicación en el aula de los contenidos de la materia. Resolución de problemas y supuestos prácticos. Realización de seminarios interactivos.
ICT practicals	Resolución de problemas prácticos en entornos TIC. Realización en equipo de prácticas de laboratorio con simuladores cuánticos.

Personalized attention	
Methodologies	Description

Assessment			
Methodologies	Competencies	Description	Qualification
Guest lecture / keynote speech	A3 A4 B1 B3 B6 B8 B12 B13 B14 B16 C1 C2 C3 C4 C7 C8	Evaluación continua de actividades realizadas individualmente. Evaluación continua de actividades realizadas en equipo. Prueba final de desarrollo de cinco preguntas cortas de la materia.	50
ICT practicals	A3 A4 B1 B3 B6 B8 B12 B13 B14 B16 C1 C2 C3 C4 C7 C8	Evaluación de prácticas individuales. Evaluación de prácticas realizadas en equipo.	50

Assessment comments
No se establece ninguna nota de corte, ni en Teoría ni en Prácticas. La nota final se obtendrá a partir de la siguiente ecuación: Nota_Final = 0.5 x (Nota_Teoría + Nota_Prácticas) Para aprobar la asignatura, se tiene que cumplir que Nota_Final sea mayor o igual a 5.00 puntos.

Sources of information

Basic	- Stuart Jonathan Russell & Peter Norvig (2021). Artificial Intelligence: A Modern Approach. Pearson - Andreas Wichert (2020). Principles of Quantum Artificial Intelligence. World Scientific ArtificialIntelligence: A Modern Approach explores the full breadth and depth of the field of artificialintelligence (AI). The 4th Edition brings readers up to date on the latest technologies,presents concepts in a more unified manner, and offers new or expanded coverageof machine learning, deep learning, transfer learning, multi agent systems,robotics, natural language processing, causality, probabilistic programming,privacy, fairness, and safe AI.ArtificialIntelligence: A Modern Approach explores the full breadth and depth of the field of artificialintelligence (AI). The 4th Edition brings readers up to date on the latest technologies,presents concepts in a more unified manner, and offers new or expanded coverageof machine learning, deep learning, transfer learning, multi agent systems,robotics, natural language processing, causality, probabilistic programming,privacy, fairness, and safe AI.
Complementary	

Recommendations
Subjects that it is recommended to have taken before
Quantum Mechanics I/614551001 Quantum Mechanics II/614551002 Fundamentals of Quantum Information/614551003 Fundamentals of Quantum Communications/614551005 Introduction to Quantum Computing/614551004
Subjects that are recommended to be taken simultaneously
Numerical Methods in Quantum Computing/614551025 Quantum Computing Tools/614551006 Quantum Computing and Machine Learning/614551008 Quantum Computing Architectures/614551022 Programming and Implementation of Quantum Algorithms/614551007 Error Correction Codes/614551013
Subjects that continue the syllabus
Practical Applications of Quantum Computing/614551010 Quantum Computing and High Performance Computing/614551009
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.