UNIVERSIDADE DA CORUÑA

Teaching Guide			
Identifying Data			**2014/15**
Subject (*)	Robótica	**Code**	614G01098
Study programme	Grao en Enxeñaría Informática		
Descriptors			

Cycle	Period	Year	Type	Credits
Graduate	2nd four-month period	Fourth	Optativa	6

Language	SpanishEnglish		
Prerequisites			
Department	Computación		
Coordinador	Santos Reyes, Jose	**E-mail**	jose.santos@udc.es
Lecturers	Becerra Permuy, Jose Antonio	**E-mail**	jose.antonio.becerra.permuy@udc.es
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Web			
General description	Na materia de Robótica estúdanse os principais conceptos de robótica autónoma, facendo énfase no deseño automático de estratexias de control. Para iso, o contido da materia parte das estratexias clásicas de control para chegar ás máis actuais baseadas en conceptos da intelixencia computacional, tales como as redes neuronais, os algoritmos evolutivos e a aprendizaxe por reforzo.		

Study programme competences	
Code	**Study programme competences**
A21	Coñecemento e aplicación dos principios fundamentais e técnicas básicas dos sistemas intelixentes e a súa aplicación práctica.
A42	Capacidade para coñecer os fundamentos, paradigmas e técnicas propias dos sistemas intelixentes, e analizar, deseñar e construír sistemas, servizos e aplicacións informáticas que utilicen as ditas técnicas en calquera ámbito de aplicación.
A43	Capacidade para adquirir, obter, formalizar e representar o coñecemento humano nunha forma computable para a resolución de problemas mediante un sistema informático en calquera ámbito de aplicación, particularmente os relacionados con aspectos de computación, percepción e actuación en ambientes ou contornos intelixentes.
A44	Capacidade para desenvolver e avaliar sistemas interactivos e de presentación de información complexa e a súa aplicación á resolución de problemas de deseño de interacción persoa-computadora.
A45	Capacidade para coñecer e desenvolver técnicas de aprendizaxe computacional e deseñar e implementar aplicacións e sistemas que as utilicen, incluídas as dedicadas á extracción automática de información e coñecemento a partir de grandes volumes de datos.
B1	Capacidade de resolución de problemas
B3	Capacidade de análise e síntese
B5	Habilidades de xestión da información
B9	Capacidade para xerar novas ideas (creatividade)
C2	Dominar a expresión e a comprensión de forma oral e escrita dun idioma estranxeiro.
C4	Desenvolverse para o exercicio dunha cidadanía aberta, culta, crítica, comprometida, democrática e solidaria, capaz de analizar a realidade, diagnosticar problemas, formular e implantar solucións baseadas no coñecemento e orientadas ao ben común.
C6	Valorar criticamente o coñecemento, a tecnoloxía e a información dispoñible para resolver os problemas cos que deben enfrontarse.
C7	Asumir como profesional e cidadán a importancia da aprendizaxe ao longo da vida.
C8	Valorar a importancia que ten a investigación, a innovación e o desenvolvemento tecnolóxico no avance socioeconómico e cultural da sociedade.

Learning outcomes			
Subject competencies (Learning outcomes)	**Study programme competences**		
Know the problems to tackle when an autonomous robotic control system is developed	A21	B3	C4
	A42	B5	C6
	A45		C8

Develop an autonomous control system for its operation in a real environment	A21	B1	C4
	A43	B3	C8
	A44	B9	
	A45		
Know the problems of knowledge representation in autonomous robotics	A43	B5	C2
		B9	C6
			C8
Know the problems of sensing and actuation in systems that operate in the real world and real time	A42	B1	C2
	A45	B9	C8
Know the non-resolved problems in autonomous robotics	A21	B5	C2
	A42	B9	C4
			C6
			C7
			C8

Contents	
Topic	**Sub-topic**
Introduction to autonomous robotics	¿What is an autonomous robot?
	History
	Sensors and actuators
	Behaviors
	Planning
	Learning and evolution
Elements of a robotic system	Robotic system
	Actuators and effectors
	Sensors
	Control architectures
Behavior-based robotics	Antecedents
	Classical control architectures
	Control architectures
Knowledge-based robotics	Knowledge
	Traditional deliberative robotics
	Navigation
Hybrid approximations	Main hybrid architectures
	Cognitive robotics
Evolutionary robotics	Evolutionary algorithms
	Application to robotics
Learning in autonomous robotics	Learning in classifier systems
	reinforcement learning: Q-learning
	Combination of reinforcement and connectionist learning

Planning			
Methodologies / tests	**Ordinary class hours**	**Student?s personal work hours**	**Total hours**
Laboratory practice	21	21	42
Supervised projects	0	30	30
Oral presentation	4	28	32
Guest lecture / keynote speech	21	21	42
Personalized attention	4	0	4

Methodologies

Methodologies	Description
Laboratory practice	Lab. sessions in which the teachers will explain the robotic platform and its development software in detail. Moreover, during these sessions, the students must perform the design, implementation and validation of the supervised projects under the supervision of a teacher.
Supervised projects	Programming exercises that must be developed using the selected robotic platform. These exercises will be carried out in an autonomous way and their progress will be supervised by the teachers
Oral presentation	Theoretical work about a specific topic from the contents that will be orally presented and discussed with other students
Guest lecture / keynote speech	Oral exposition by the teachers of the theory of the subject.

Personalized attention

Methodologies	Description
Laboratory practice Supervised projects Oral presentation	During the lab practices and tutorials, the student can consult the teacher all the doubts that appear about the realization of the formulated practical problem or about the use of the simulator or the real robot. Supervised projects: It is recommendable the use of a personal assistance in these activities to resolve conceptual doubts or procedures than can appear during the resolution of the practical problems. Also, the personal assistance will be focused on in the explanation, by the student, of the proposed solution. Oral presentation: the students progress in their theoretical work must be supervised by the teachers, both in terms of contents and format.

Assessment

Methodologies	Description	Qualification
Guest lecture / keynote speech	The attendance to the keynote speeches will be considered in the final mark	5
Laboratory practice	The attendance to the laboratory classes will be considered in the final mark	5
Supervised projects	Different programming projects will be proposed along the course that must be carried out in an autonomous way by the student and that will be presented and explained to the teachers afterwards. It is mandatory to pass this methodology independently in order to pass the whole subject.	55
Oral presentation	The oral presentation, the participation in the discussion and the written inform will be considered in the final mark. It is mandatory to pass this methodology independently in order to pass the whole subject.	35

Assessment comments

Evaluation of this course is based on independently overcoming the two main methodologies: supervised projects and oral presentation. The first one focuses on the practical demonstration of the knowledge and skills acquired to solve problems in autonomous robotics, and the second one in the completion and presentation of a paper on a specific topic within theoretical agenda.

Thus, if the student does not pass the subject in the ordinary call, he / she shall repeat all activities that were not passed in the extraordinary call. As an example, if a student passed the oral presentation but failed the supervised projects, he / she shall repeat these.

Students with part-time enrollment can displace the 5% of the qualification of the attendance to the other activities, both in theory and in practice, in case they can not regularly attend classes. This change in the qualification methodology shall be applied to teachers of the subject at the beginning of the course.

Sources of information

Basic	- Bekey, A. (2005). Autonomous Robots. MIT Press
	- Arkin, R.C. (1998). Behavior Based Robotics. MIT Press
	- Santos, J., Duro, R.J. (2005). Evolución Artificial y Robótica Autónoma. RA-MA
	- Mataric, Maja J. (2007). The Robotics Primer. MIT Press
Complementary	- Santos, J. (2007). Vida Artificial. Realizaciones Computacionales. ServicioPublicaciones UDC
	- Floreano, D. and Mattiussi, C. (2008). Bio-Inspired Artificial Intelligence. Tema 7. MIT Press
	- Salido, J. (2009). Cibernética aplicada. Robots educativos. Ra-Ma
	- Nolfi, S., Floreano, D. (2000). Evolutionary Robotics. MIT Press
	- Thurn, S., Burgard, W., Fox, D. (2005). Probabilistic Robotics. MIT Press
	- Sutton, R.S., Burton A.G. (1998). Reinforcement Learning. MIT Press
	- Pfeifer, R. and Scheier, C. (1999). Understanding Intelligence. MIT Press

Recommendations
Subjects that it is recommended to have taken before
Subjects that are recommended to be taken simultaneously
Subjects that continue the syllabus

Sistemas Intelixentes/614G01020

Representación do Coñecemento e Razoamento Automático/614G01036

Desenvolvemento de Sistemas Intelixentes/614G01037

Aprendizaxe Automático/614G01038

Other comments