Course Title	Robotics and Perception				
Course Code	AI645				
Course Type	Elective				
Level	Master (2nd Cycle)				
Year / Semester	1st Year/2nd Semester or 2nd Year/1st Semester				
Teacher's Name	TBA				
ECTS	7	Lectures / week	Up to 6 Teleconferences	Laboratories / week	None
Course Purpose and Objectives	Robotics is one of the emerging technologies that has been identified by researchers and industry leaders around the world. Robots can be controlled manually, semi-autonomously or fully autonomously. Having an autonomous robotic system requires the system to make decisions which most of the times are based on artificial intelligence algorithms. This course tries to introduce the students to the foundations of artificial intelligence in the context of robotic systems. The course introduces students to machine learning for robotics, and then goes on to present developmental-based algorithms, robot learning, motion and sensing. The course then presents robot perception and collaborative robotic systems while ending with an introduction to robot ethics.				
Learning Outcomes	Upon succesful completion of this course students should be able to: • Describe how robots can learn from animal and human development processes • Discuss how robots can sense their environment • Relate robotic motion in legged robots and arm manipulators • Describe how robots use vision to recognize their environments • Identify the issues relating to robot and AI ethics				
Prerequisites	None	Co-requisites	None		

Course Content	1: Robotics and AI Foundations Understanding the basic principles of robotics and artificial intelligence 2: Developmental robotics Understanding the biological foundations and developmental behaviors and how these can be used in developing artificial intelligence in robots 3: Robot Learning How robotic systems learn by use of reinforcement learning and evolutionary algorithms 4-5: Robot Motion Biped motion, four/six legged motion, arm motion, arm manipulation, reaching and grasping 6: Robot sensing Movement sensors: optical encoders, magnetic encoders, tactile sensors, ultrasonic rangefinders, laser rangefinders 7-8: Robot perception Intelligent object detection, reinforcement learning for mobile robots, object tracking, motion estimation 9: Collaborative robots Homogeneous teams and swarms, heterogeneous teams, cooperation, goals 10-11-12: Navigation Topological Path Planning, Metric Path Planning, Localization and Map Making 13: Robotics and AI Ethics Social and ethical issues related to robotics and artificial intelligence.
Teaching Methodology	E-Learning
Bibliography	An Introduction to AI Robotics (Intelligent Robotics and Autonomous Agents), Robin R. Murphy, Latest Edition Artificial Intelligence for Robotics: Build intelligent robots that perform human tasks using AI techniques, Francis X. Govers, Latest Edition Developmental Robotics: From Babies to Robots (Intelligent Robotics and Autonomous Agents series), Angelo Cangelosi, Matthew Schlesinger, Linda B. Smith, Latest Edition Robot Ethics: The Ethical and Social Implications of Robotics (Intelligent Robotics and Autonomous Agents series) Latest Edition Autonomous Robots: From Biological Inspiration to Implementation and Control (Intelligent Robotics and Autonomous Agents series), George A. Bekey, Latest Edition Machine Learning and Robot Perception, Apolloni, B., Ghosh, A., Alpaslan, F., Patnaik, S. (Eds.) Latest Edition.

Assessment	Final Examination	50%
	Assignments/On-going evaluation	50%
		100%
Language	English	