Master of Science in Artificial Intelligence (MSAI)

Course Name	Robotics Applications		تطبيقات علم الروبوتات		
Course Information	Course Code	Course No.	Credit Hour	Prerequisite(s)	
	0911-1677	677	3 (3-0-6)	Foundations of AI	
Course Track	Program Core		Electives		

Course Description. Robotics as an application draws from many different fields and allows automation of products as diverse as cars, vacuum cleaners, and factories. Robot design requires integrating a mechanical structure, one or several actuators, one or several sensors, and a controller governing the robot behavior. This controller has also to be implemented by using the dedicated IT tools. The goal of this course is to provide a global vision of robotics challenges to Master students, both in classical applications (industrial robotics) and in more avant-gardist applications. Topics include simulation, coordinate frames, homogeneous transformations, kinematics, control, optimization, and probabilistic inference. In addition, the course contains practical approaches such as manipulator dynamics, Jacobians- velocities and static forces, trajectory planning, Actuators, Sensors, Vision, Fuzzy logic control of manipulator and robotic programming. The mathematical basis of each area is emphasized, and concepts are motivated using common robotics applications and programming exercises. Students will participate in a series of projects over the course of the semester, in which they will implement algorithms that apply each of the topics discussed in class to real robotics problems. Using a hands-on approach, the students in this course will design and fabricate robot prototypes in a group-based term project using controller programs and standard microcontrollers.

Course Outcomes. After the completion of this course, the student will be able to:

- 1. Describe the concepts and theories related to the domain of AI and machine learning for robotic vision [A]
- 2. Select appropriate sensors for performing robotic tasks [B]
- 3. Relate and adapt forward and inverse kinematics problems [C]
- 4. Identify primitive objects employing robotic vision and machine learning techniques [D]
- 5. Analyze the methods for manipulator kinematics and operate with the resulting equations [C]
- 6. Understand the ethical concerns in developing robotics-based solutions. [F]

Assessment	Assignments	15%	Quiz		Capstone	40 %			
Policy (PC)	Midterm	15%	Final	30%	Project	H 0 /0			
Textbook	Saeed B. Niku, "Introduction to Robotics: Analysis, Control, Applications", 2 nd Edition, Wiley								
	Publisher, 2011, 9780470604465.								
References	1. S.K Shaha, "Introduction to Robotics", 2 nd Edition, McGraw-Hill Publisher, 2014. ISBN-								
	9332902801								
	2. John J. Craig, "Introduction to Robotics: Mechanics and Control", 4 th Edition, Pearson, 2017.								
	ISBN-13: 9780133489798.								

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