



**UNIVERSITY OF JORDAN**

# **MSc IN ARTIFICIAL INTELLIGENCE AND ROBOTICS**

(Student Handbook)

**DEPARTMENT OF COMPUTER ENGINEERING  
&  
DEPARTMENT OF MECHATRONICS ENGINEERING**

## **Program Description**

It is a program of applied nature that seeks to qualify and graduate experts capable of employing modern technologies in the fields of AI and Robotics to provide solutions that benefit all areas of life. It mainly targets bachelor students in the disciplines of electrical engineering, computer engineering, mechatronics engineering, electrical engineering, communications engineering, and biomedical engineering. The program also accepts undergraduate students from other engineering majors, artificial intelligence, and information technology.

## **Vision**

An applied program in artificial intelligence and robotics that graduates experts who exploit these technologies for the benefit of their societies and businesses.

## **Mission**

Providing the public and private sectors with highly qualified specialists in the fields of artificial intelligence and robotics. The master's program in artificial intelligence and robotics provides high-quality academic courses and labs that enable students to get a hold on the rapid technological developments. The students benefit from the advancing computer capabilities in designing and developing innovative, reliable, and sustainable technical solutions for practical problems facing all aspects of today's world. The program provides the various sectors of the regional and global markets with qualified graduates in these fields.

## Faculty members and labs

The program is managed by faculty members from the Computer Engineering and the Mechatronics Engineering Departments at the University of Jordan. The faculty members are specialized in Artificial Intelligence and/or Robotics and have many publications in this domain. There are two new labs dedicated for this program; the Artificial Intelligence lab and the Robotics lab. The labs are equipped with new PCs, workstations and robots to help the students apply the learned concepts and do their research. for more information you can visit the departments webpages:



**Computer**

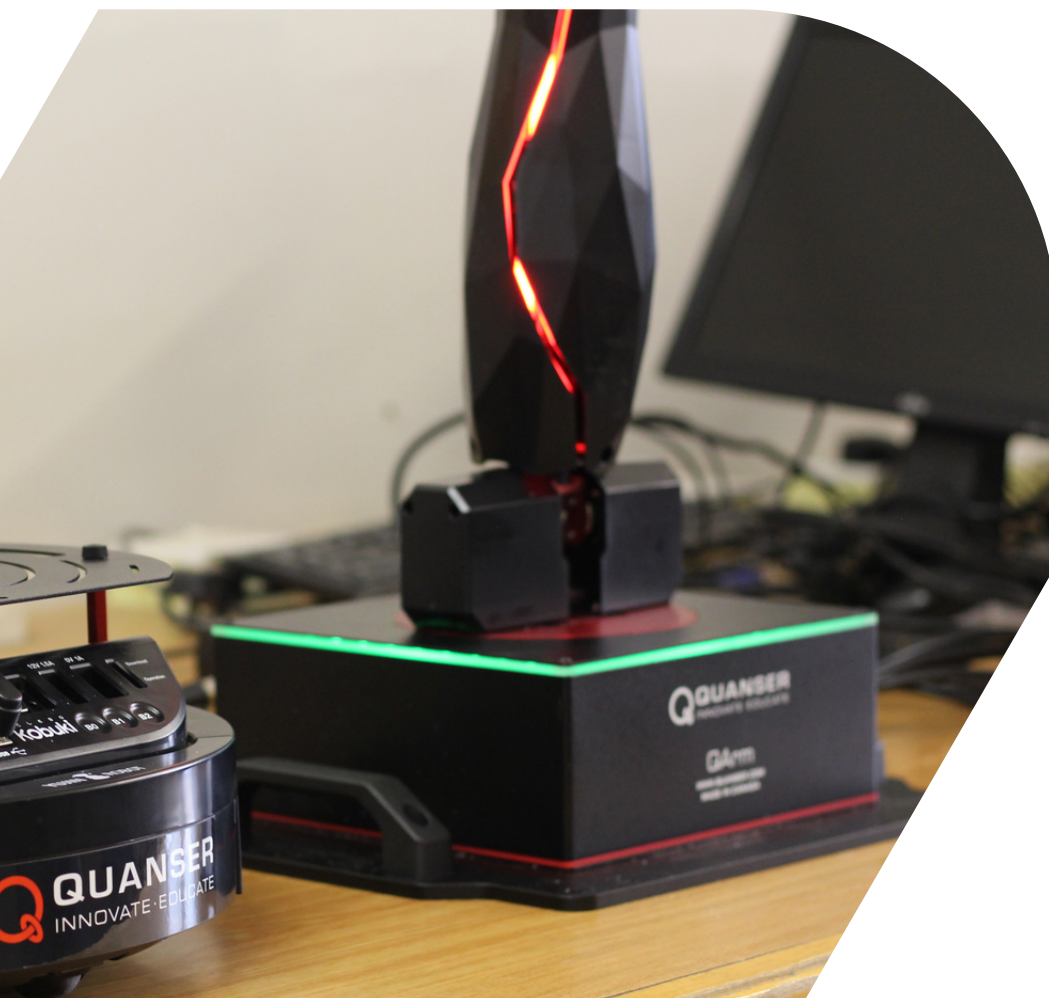


**Mechatronics**



## 1. Obligatory Courses (15) Credit Hours:

| COURSE NO. | COURSE TITLE                    | CREDIT HRS. | PREREQUISITE |
|------------|---------------------------------|-------------|--------------|
| 0907703    | Research Methodology            | 3           | -            |
| 0907743    | Applied Machine Learning        | 3           | -            |
| 0907752    | Computer Vision                 | 3           | 0907743      |
| 0908721    | Robotic Systems                 | 3           | -            |
| 0908722    | Industrial and Applied Robotics | 3           | 0908721      |



## 2. Elective Courses: Studying (9) Credit hours from the following:

| <b>COURSE NO.</b> | <b>COURSE TITLE</b>                               | <b>CREDIT HRS.</b> | <b>PREREQUISITE</b>          |
|-------------------|---|--------------------|------------------------------|
| <b>0907725</b>    | <b>Internet of Things Applications</b>            | <b>3</b>           | <b>-</b>                     |
| <b>0907753</b>    | <b>Natural Languages Processing</b>               | <b>3</b>           | <b>0907743</b>               |
| <b>0907754</b>    | <b>Unsupervised Learning</b>                      | <b>3</b>           | <b>0907743</b>               |
| <b>0907755</b>    | <b>Reinforcement Learning</b>                     | <b>3</b>           | <b>0907743</b>               |
| <b>0908759</b>    | <b>Advanced Topics in Artificial Intelligence</b> | <b>3</b>           | <b>0907743</b>               |
| <b>0907761</b>    | <b>Applied Data Science</b>                       | <b>3</b>           | <b>0907743</b>               |
| <b>0908723</b>    | <b>Autonomous Mobile Robots</b>                   | <b>3</b>           | <b>0907743 &amp; 0908721</b> |
| <b>0908725</b>    | <b>Advanced Control Theory</b>                    | <b>3</b>           | <b>0908721</b>               |
| <b>0908751</b>    | <b>Advanced Topics in Robotics</b>                | <b>3</b>           | <b>0908721</b>               |

## **3. Courses description**

### **0907703: Research Methodology 3 Cr. Ho**

Introduction to the research process: Formulating research problems, Asking research questions and finding answers, Making arguments, Writing research arguments, and Ethics of research. Topics in performance evaluation: Selection of evaluation techniques and metrics, Types of workloads and workload selection, Data presentation and ratio games, Summarizing measured data and comparing systems, Introduction to experimental design, and Introduction to simulation and analysis of simulation results. Ethical, safety, and social impact issues related to engineering solutions. Term project in preparing and presenting a research proposal or research report.

### **0907725: Internet of Things Applications 3 Cr. Ho**

The course starts by reviewing networks and TCP/IP protocol stack. Then, the course will focus on concepts related to IoT including: Defining IoT, Characteristics of IoT, 5G communication and its relation to IoT, Physical design of IoT, Logical design of IoT, Machine to Machine, Industry applications, Surveillance applications, Body Area Networks, Smart Homes, Smart City, and other IoT applications. Term project.

## **0907743: Applied Machine Learning**

### **3 Cr. Ho**

This graduate course concentrates on the application of state-of-the-art AI and machine learning algorithms for solving real-world problems. This course starts with reviewing the Python programming language and its important related packages. The covered topics include data preparation, training, evaluation, metrics, supervised learning (regression, classification, neural networks, deep learning, convolutional neural networks, and recurrent neural networks), basics of unsupervised and reinforcement learning, and recommender systems. This course has practical assignments and term project.

## **0907752: Computer Vision**

### **Pre-requisite: 0907743**

### **3 Cr. Ho**

Introduction to computer vision including fundamentals of image formation, camera imaging geometry, feature detection and matching, stereo, motion estimation and tracking, video processing, image classification and scene understanding. The course focuses on robotics applications and applications that include finding known models in images, depth recovery from stereo, camera calibration, image stabilization, automated alignment, tracking, boundary detection, and recognition. Term project.

## **0907753: Natural Languages Processing**

**Pre-requisite: 0907743**

**3 Cr. Ho**

Computational properties of natural languages. Coreference, question answering, and machine translation. Processing linguistic information. Syntactic and semantic processing. Modern quantitative techniques in NLP. Neural network models for language understanding tasks. Term project.

## **0907754: Unsupervised Learning**

**Pre-requisite: 0907743**

**3 Cr. Ho**

This is a graduate-level course in unsupervised machine learning. This course covers classical and modern techniques for solving problems in machine learning beyond traditional supervised learning, including fitting statistical models, dimensionality reduction, clustering, anomaly detection, density estimation, and exploratory data analysis and visualization. This course has practical assignments and term project.

## **0907755: Reinforcement Learning**

**Pre-requisite: 0907743**

**3 Cr. Ho**

The course is about prediction and control using reinforcement learning, including aspects of deep reinforcement learning, i.e., the application of neural networks-based functional approximation to reinforcement learning problems. The course covers theory and applications related to the following topics: Markov decision processes. Value function approximation. Policy gradient methods, Actor-critic algorithms. Integration of Learning and Planning. Exploration vs exploitation trade-offs. Term project.



## **0907759: Advanced Topics in Artificial Intelligence**

**Pre-requisite: 0907743**

**3 Cr. Ho**

Topics of special interest in current Artificial Intelligence issues. The department at every course offering specifies the course description.

## **0907761: Applied Data Science**

**3 Cr. Ho**

This is a graduate-level course in applied data science. The course covers the basic definitions, concepts and skills in data science including importing datasets, data cleaning and preprocessing, data visualization and summarization, building predictive and regression models, and designing data pipelines for real-life problems. This course has practical assignments and term project.

## **0908721: Robotic Systems**

**3 Cr. Ho**

This course introduces students to the fundamentals of robotic systems including kinematics and dynamics as applied to manipulators and mobile robots. It also describes the operation and application of a range of sensors and how they can be applied to a mobile or static robot system. The theory of motion control systems and how they are applied in robotics are also introduced in addition to many types of actuators and drive systems. Term project.

## **0908722: Industrial and Applied Robots**

**Pre-requisite: 0908721**

**3 Cr. Ho**

Introduction to robotic manipulator arms; types of joints; number of degrees of freedom; the concept of a workspace; forward kinematics; inverse kinematics; Jacobian; dynamics; simulation of robotic manipulator arms using robotics toolbox; examination of real robots from commercial companies; applications in the industry (e.g., palletizing, welding, spraying, and picking fruits). Term project

## **0908723: Autonomous Mobile Robots**

**Pre-requisite: 0907743 & 0908721**

**3 Cr. Ho**

This course begins with the most important mechanisms that enable locomotion. The course then proceeds to mobile robot kinematics by applying principles of kinematics to the whole robot. The challenge of perception, mobile robot localization, and planning and navigation are also discussed. The course also covers intelligent agents, autonomous agents, autonomous robots, intelligent robots and the fine line between intelligent agents and autonomous robots. Term project.

## **0908725: Advanced Control Theory**

**Pre-requisite: 0908721**

**3 Cr. Ho**

This course aims to provide the basic theory required for solving complex control problems. Concepts and techniques of linear and nonlinear control system analysis and synthesis will be studied. The role of feedback in control will be reinforced, alongside the role of optimization techniques.

## **0908751: Advanced Topics in Robotics**

**Pre-requisite: 0907743 and 0908721**

**3 Cr. Ho**

Topics of special interest in current Robotics issues. The department at every course offering specifies the course description.

## Useful links:

### School of graduate studies

Which contains information like: academic calendar, announcement, and other information related to the graduate programs.



### Graduate studies forms

All the forms the graduate students need for different procedures during their studies.



### University rules and regulations

The university regulations for awarding Master's degree can be found using this link, under the seventh item. The Regulations are titled as: **تعليمات منح درجة الماجستير (في الجامعة الأردنية)**



# CONTACT US

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**DeCAIR Website**



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